The TOOL ENGINEER

JUNE, 1940

Official Publication of the

AMERICAN SOCIETY OF TOOL ENGINEERS

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Contents

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HANNIFIN

NUMBER 10 TOOL ROOM MACHINE

To Have and to Hold

AN EDITORIAL

By A. E. RYLANDER

AT date (May 20th) a totalitarian machine rolls relentlessly toward its objective. Before it, neutral minorities—already sapped by the "fifth column"—resist awhile then surrender to the inevitable, while the forces of democracy strive to arrest its progress. And, before this writing gets to press, the machine may have decided the political destiny of Europe "for a thousand years."

Now, there is talk of United States intervention, and certainly there is favor for the Allies despite our overt neutrality. Cut off from European supplies, England and France must now rely on the Americas for food, raw materials and finished essentials for civilian as well as military needs.

Let us regard the situation coldly, divorced from all emotional and idealistic bias. We'll consider the facts, with such assumptions as have tenable basis on known quantities. Taking these as they come to mind, rather than in logical sequence, they are: (1) That the Allies are losing the war as of date because they were not prepared, this despite that they were alive to the inevitableness of war and had had authoritative warning of the (potential) enemy's superiority in air and field. (2) That, belatedly, they realize their remissness and now draw on America for planes, but, (3) at our best rate of production we cannot bring them to parity before '41—when the issue may have been decided—and, (4) that we can furnish planes and military supplies only at sacrifice to our own resources of defense. Finally, we are not prepared for defense, let alone an offensive, hence, intervention will no doubt be confined to parliamentary debate.

Fortunately, however, the people of the United States, and their chosen representatives, are largely of a mind regarding a defense program. We say, "largely of a mind," for there is the "fifth column" to consider, and that force of subversion must be reckoned with—and cancelled! But the F.B.I. can take care of that, as industry will take care of the first line of defense—the Machine. And, as the zero hour of "M Day" strikes, we suggest that, in war as in peace, the Tool Engineers hold their place as the key men of industry. That truism is as pat now as when first laid down in the editorial pages of the TOOL ENGINEER.

At the moment, America is ill prepared for war, but our country is adequately endowed with the executive and engineering brains, and the mechanical skill, to initiate such a program of defense that we can be comparatively immune, not only against invasion, but interference with our international commerce. For in this day and age, armed superiority alone is the insurance policy for peace. Let us, however, proceed coldly, without waste and without mass hysteria; let us execute our defense program without destroying our avenues of peaceful commerce. Let us—to use a trite phrase—eat our cake and have it, too, for on this paradoxical feat rests our economic salvation.

After all, the end of war is peace, and it is when the terms of settlement are signed that the real war starts—the ostensibly friendly but keenly competitive war for world markets. And, should Germany prevail in Europe (a not improbable contingency) American business and industry will be in direct competition with the inventive and industrial genius of an intelligent and aggressive people. For don't be deluded—German industrialists are already preparing for this war after war. If we coldly consider this phase we will not only be forewarned but forearmed, and we already have evidence that preparedness and planning win blitzkriegs in the arena of war. Why not, then, in the fields of commerce?

In proposing these things, we feel that we have a certain vantage of authority, as befits a body trained in analytical thinking and execution. For in the final analysis, it is the engineers who will be entrusted with the job of evolving the Machine; more, it will be our job to improve on the best that the world knows today. We believe that we can do this, base belief on the known quantity that, so far, American technology has largely set the pace for the world. On that premise, then, we suggest that:

The government decides its defense program and, with minimum debate, gets started. But, let industry determine the orderly execution of its share in the program, that peacetime commodities be manufactured as heretofore. There is no valid reason for disorganizing business and industry, considering that one of the main objectives of war is to achieve the economic stability of one's country. Every person now employed in gainful occupation is a unit in the bulwark of our economic structure, and we have some twelve million of idle employables. We say, put these men and women to work, either directly onto war material or into established industry to replace those actually needed for the munitions of defense.

By so doing, we have the twofold advantage of solving an acute unemployment problem and that, as a people, we underwrite our national security. For remember, this land of ours has been entailed by forbears who paid for it in blood and suffering; it is now ours to have and to hold. But to have it, we must be prepared to anticipate any power or combination of powers that may emerge as a result of the conflict overseas, and to hold it, as the leader in world standards of living, we must maintain our industrial and commercial advantage. America, prepare!—for defense and economic leadership. To this program the Tool Engineers of America give their unqualified support.

The Need for Top Rake on Form Tools

By HAROLD P. BERRY
EDITOR, "SCREW MACHINE ENGINEERING"
SENIOR TOOL AND GAGE DESIGNER, NAVAL GUN FACTORY, WASHINGTON, D. C.

TOP-RAKE in conjunction with circular and flat form tools is defined as having an inclined cutting edge which does not coincide with the plane of the machine spindle center line and directional travel of the tool.

Top-rake increases the life of a form tool and materially adds to the number of pieces between sharpening grinds. Top-rake produces a smooth finish, reduces chip difficulties and causes better machinability since a form tool with top-rake will shear the metal instead of the usual fashion of cutting which involves some scraping action. Higher spindle speeds are possible since top-rake cutting action generates less heat. Of importance is the fact that, with top-rake, there is less chance for "metal cling" at the cutting edge.

As will be shown, top-rake, also referred to as "hook" or rake cutting edge, is used daily to advantage with other tools, but its use is intentionally sidetracked when circular or flat form tools are used to produce two or more diameters on a part. This is due to unusually high engineering cost in the design of a form tool with top-rake and because most operators do not thoroughly understand the use of top-rake. Both of these objections can be overcome by bringing the subject "out into the open" for consideration and thorough understanding.

Some Examples

I will give typical examples to show the advantageous use of top-rake, beginning with the common garden rake which is fashioned for handy use because the prongs are set at an angle with the face of the ground to readily remove the unwanted materials. If the handle were placed close to the ground with the prongs perpendicular to the ground, the materials could not be removed, at least not so easily or completely. When the ordinary garden spade is used, the steel blade is inclined to force it into the ground. Less exertion is required to force the blade at the inclined angle and the separated materials are removed more readily.

The "hook" or inclined angle of top-rake cutting edges of metal cutting tools performs in a similar manner as does the common garden rake and spade. The inclined angle separates the material by co-operating with the "slip bands" of the internal structure of the metal. The ordinary hand file has "hooked" teeth made intentionally for the purpose of removing materials faster with better and smoother surfaces remaining. The highly developed broach is arranged with an inclined angular cutting edge at each progressively stepped cutting edge. Plain milling cutters have a decided shearing action because of the inclined angle of top-rake applied to each spiral cutting edge. Fluted drills are another typical example—notice the "hooked" end cutting edge on a fluted drill. Saws, taps, dies and other standard tools have the inclined cutting edge of top-rake incorporated for a definite purpose—to remove materials with less exertion on the part of the tool.

The metal working industry can profit materially from the lesson taught by the woodworking industry. Woodworking cutters are usually "built-up" and each cutting edge is set in the body as an inserted blade and having a predetermined angular setting. The angularity of the cutting edges is a definite requirement as, without it, the tool could not possibly cut, instead, it would tear the surface of the wood.

An apprentice machinist soon learns that a lathe tool bit will "cut better" after placing a "hook" in the top face of the tool. The favorable aspect of top-rake is learned through indisputable evidences directly connected with production equipment in the screw machine industry. The positive evidence is presented by the "hook" invariably placed on all turning tool bits of the common lathe type and those used in "knee" and "roller" turners on automatic screw machines, chucking machines and turret lathes. This "hook" is often incorporated in these turning bits as a chip "breaker." Functioning as intended, the "hook" is not generally appreciated as being responsible for the better finish obtained. Innocently imposing the "hook" or top-rake, the operator improves the cutting quality of the tool by definitely reducing the pressures required to separate the chip from the bar or material being cut.

Other tools work "much better" with the "hook" so why not with the form tool? The form tool will work better with the top-rake but correct top-rake cannot be placed at the cutting edge if the form tool was not originally made for the use of top-rake. Placing a top-rake on a form tool originally made to cut without top-rake, naturally lengthens the shape depths in the plane of the top-rake incorporated and the form tool "won't make the part right."

As men responsible for the actual production of parts, you know the definite need for top-rake for circular and flat form tools. As engineers, you have experienced the task caused by the lengthy calculations involved in the design of circular and flat form tools having top-rake.

Top-Rake for Better Production

The need for top-rake is shown by the fact that set-up men and operators will apply top-rake to form tools intended to be used without top-rake. They know, however, that they are limited to the amount of top-rake which can be applied since a greater amount would produce diameters in variance with the specified tolerances. To gain the benefits of top-rake and avoid calculations, some screw machine departments use the "trial and error system." This means that form tool steps are corrected for top-rake not by calculation, but by trial on the machine and changing of the steps on the tool until it produces the part within the given tolerances. The trial on the production machine and changing of the steps by grinding occurs many times before the desired results are obtained. With this system, great expense and machine down time are readily apparent.

Manufacturers of automatics, chucking machines and turret lathes are constantly making improvements for higher spindle speeds and greater rigidity of moving parts. Sources of supply for materials are conducting extensive investigations to change the internal structure of material to improve machinability. Tool steel manufacturers are in harmony with the movement as evidenced by the many patented types of high grade tool steel to match the higher spindle speeds and cutting speeds, including cutting tools with sintered ingredients used as a molded tip. Better coolants are the result of similar forethought and work. All of the foregoing intense interest is for one purpose—production with the best results and lowest cost. Then, why overlook or avoid the last important step of top-rake for circular and flat form tools to materially assist in this one general desire for improved production? Are you to be satisfied with your present good results when even better results are possible?

The desire to use top-rake is shown by the trend of organizations to purchase machines equipped with holders for flat form tools. This course is followed since it is easier to calculate top-rake for flat form tools in comparison to calculations required for top-rake in conjunction with circular form tools. This is due to the fact that the flat form tool requires only the consideration of the compound angularity of both pressure and top-rake angles. With the circular form tool, the placement of the tool center enters the calculation requirements and adds materially to the usual trigonometric formulae.

(Continued on page 50)

DRILLS *plus* BRAINS *produce* PROFITS

Once this operation required two drills and two jigs—twice the expense, twice the time. Not now, though. A G. T. D. Greenfield engineer suggested a special step-drill and as a result, a certain plant foreman is congratulating himself on a substantial cost reduction.

Here's the point: G. T. D. Greenfield engineers are continually analyzing actual threading, drilling and reaming operations in plants of all types. They acquire a vast fund of practical ideas which they can bring to any manufacturer who seeks their advice. Sometimes a variation in even such points as speed or lubricant will mean savings as substantial as those which involve actual tool design. Give your friend, the G. T. D. Greenfield engineer, a chance.

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Screw Machine Tooling for Aircraft Engines

By N. W. TAYLOR

FOREMAN AUTOMATIC SCREW MACHINE DEPT., WRIGHT AERONAUTICAL CORPORATION, PATERSON, NEW JERSEY

IT must be obvious to those not connected with the aircraft engine industry that there are many phases of Tool Engineering peculiar to this business alone. Naturally most of the unusual materials used have the ability to withstand the high stresses to which they are subjected and are difficult to fabricate to the superlative finishes desired. Just how much the screw machine or turret lathe, whether it is of the hand type, semi-automatic or fully automatic, can play in this industry has taken a full twenty-five years to determine. Some past history will best qualify this statement and also bring to light some of the important parts Tool Engineers have played in the picture.

Old Tools—Old Methods

When the Simplex Automobile Co., of New Brunswick, N. J., (later the Wright-Martin Aircraft Corp.,) acquired the manufacturing rights of the French designed Hispano-Suiza aeroplane motor in this country in the year 1915, their Tool Engineers found it difficult to adapt its parts to American manufacturing methods. Tool designers from high grade automobile plants lent their respective abilities but they were limited to tool steels which did not have the qualifications of present day materials. Screw machines and turret lathes were designed with feeds suitable for brass and the free machining steels of that time. The alloy steels specified for parts varied from bar to bar in size, roundness and machinability. Operators on the aforementioned machines, working under the Taylor time study system made plenty of bonus if their keen eyesight enabled them to pick the best machining bars by the color of the first pieces off the ends. Poor ones were removed from the collets and placed back in the racks for operators who did not know the difference or had to finish up the job.

Lard oil was the cutting agent used, but as its price became prohibitive, substitutes were introduced which varied as much as the material machined and cutting qualities of the tools. Suspended on a wire on the side of each hand screw machine used for cutting threads was a small can containing white lead and cutting oil. This miraculous mixture was dabbed on the blanks with a brush before starting the dies to produce what was then considered smooth threads. Twist drills were makers' standards and inferior to those now available. Reamers were occasionally special but mostly ordered from catalogues. In some cases they were held solidly but generally in floating holders, driven by either a cross pin or combination of cross pin and a ball which socketed in the center of the shank end. Operators laboriously stoned just enough back taper on the outside diameter of the reamers to keep no-go plug gages from entering.

Form tools were well designed but the material from which they were made, the 18-4-1 steel of that day had decided limitations and variable results were obtained in the heat treatment of them. Oil stones were also used extensively to provide side clearances impractical to incorporate in the design. On the hand screw and turret lathe the operator was furnished with a small brass rod which he rubbed over the cutting edges of the tools each time a piece was formed to remove the built-up edge. The same tool was then returned a second time for a smoother finishing cut. Then came the application of emery cloth, sometimes preceded by a file to smooth up the part just enough to pass inspection. The emery and file dust thus released worked into the oil pump and the machine slides. Eventually came the repairing of the slides and then another cycle of the same abuse.

Parts made on the automatics had decidedly rough finishes and practically all surfaces were thereafter ground, polished or given skim cuts. Rough reamed holes were re-reamed and drilled holes reamed as secondary operations. By setting box tool rolls down to .005" to .008" under the trial cutting size of the tool bit, a fairly smooth surface was obtained. None of the threading done would now be considered smooth.

During this period the Curtiss Aeroplane & Motor Co., of Buffalo, N. Y., were having their difficulties in producing a motor of American design. When this country entered the World War two American automotive engineers designed the Liberty motor, and its manufacture with that of the Hispano-Suiza and Curtiss motors continued during our participation. With the termination of hostilities came a liquidation and a reorganization of the Curtiss and Wright-Martin Companies, the latter taking the name of the Wright Aeronautical Corporation. The manufacture of Liberty motors in the several plants throughout the country ceased.

Tool Engineers Did a Job

In the final analysis of the part the Tool Engineer played during this period we can compliment him to the extent that he adapted to good advantage his automobile experience in screw machine design to this new industry. There were, however, too many handicaps in the way of noncomparable engine design, lack of uniformity in alloy steels used and suitable tool steels for the machining of them, excessive automatic feeds and last but not least, a time study system which could function properly under these conditions.

The lull at this time in the demand for aeroplane engines gave the comparatively few who survived the sudden deflation an opportunity to bring forth better motors more adaptable to American methods. Such a combination of ambition and genius was bound to produce results in a country rewarding individual initiative. Management, engineers and workmen evolved ways and means of manufacturing small quantities of material economically enough to exist and eventually brought forth a better product to add to this country's laurels. The introduction of air cooled motors presented new manufacturing problems but Tool Engineers were again able to apply some of their previous automobile experience to good advantages.

Lindbergh's flight to Paris in 1927 awakened the world to the new possibilities of aviation. Rapid expansion in the aeroplane industry followed. The trained personnel of three small organizations guided new employees who had no similar experience. Many returned to their former employment bringing with them new ideas and some applicable experience. Most former tool designs were retained because a marked improvement in the uniformity of alloy steels gave tool de-

It must be obvious to those not connected with the aircraft engine industry that there are many phases of Tool Engineering peculiar to this business alone. Naturally most of the unusual materials used have the ability to withstand the high stresses to which they are subjected and are difficult to fabricate to the superlative finishes desired. Just how much the screw machine or turret lathe, whether it is of the hand type, semi-automatic or fully automatic, can play in this industry has taken a full twenty-five years to determine. Some past history will best qualify this statement and also bring to light some of the important parts Tool Engineers have played in the picture.

signers a better opportunity to apply sound design to tools for screw machines and turret lathes. Considerable progress had been made in sulphurized cutting oils for use on these machines but external threading still responded best to the mixture of white lead and oil previously mentioned. Super high-speed steel tools permitted higher surface speeds and feeds. Improved universal hand screw machines with a greater variety of speeds and feeds made possible the making of parts from free machining aluminum alloys to limits which were not possible on even engine lathes during the World War. The rapid traverse of the automatic screw machine had been incorporated in turret lathes to good advantage. Milling of coarse threads where narrow undercuts could not be avoided in the design of parts, using hobs made from improved tool steel created new jobs for automatics in the making of blanks.

Eventually came the collapse of the second boom and then the consolidation of the Curtiss and Wright Companies to leave two major competitors at this time in the field. The lull gave those who survived another opportunity with their backs to the wall to bring forth new motors of lighter weight and more dependability to make commercial air transportation a reality and open up a large foreign market. American machine tools and Tool Engineering had been available to foreign concerns making motors of their own design, but the peculiarities of tooling of screw machines and turret lathes for aircraft engine manufacture were not well known to machine tool manufacturers and their staffs of Tool Engineers so the results obtained abroad were only as good as their parallel automobile experience here. Licensing of foreign concerns and governments during the past few years has released to them a store of manufacturing methods and tool designs but only on models released by the United States War Department and any information I am imparting to you is only that available to any licensee because the Espionage Act forbids enlightenment on tooling, manufacturing methods and engine design on models not released.

A New Opportunity

Increased patronage of commercial air lines, foreign demands and those of our own army, navy and coast guard in the year of 1936 gave a new impetus to engine manufacture. Executives, supervisors, foremen and Tool Engineers who visited the National Machine Tool Builders Association Show in Cleveland, Ohio, in the fall of 1935 brought back to their plants a host of ideas, and the aircraft engine industry—on the eve of the healthiest expansion it had yet experienced—particularly benefited. In the eyes of the screw machine tool designer there was much field for application of his previous designs to better advantage. Independent feeds for tool and cross slides, more spindles, greater variety of speeds and feeds, rigidity to permit the use of brittle tools, improved bearing design and other features overcame many weaknesses. New machine tools had to be purchased cautiously to prove their worth. Semi-automatic turret lathes made one of the best showings in savings, but there was still a lack of volume even at this time to definitely establish the screw machine and turret lathe as a predominant factor. It is however now firmly established due to that enormous volume of United States and foreign business. Machine tool manufacturers are now given the opportunity to submit or furnish their own layouts and tool designs. Many jobs are satisfactory but some are such that only those closely identified with the aircraft engine industry can furnish the solution. Feed and speed data taken from the records of our Standards Department furnish valuable information for new layouts, even though some of it is compiled from machines which do not have the latest features.

Aircraft Parts Vended

When a new model of motor is introduced in our plant it is tooled for moderate quantities on turret lathes and automatics. As production increases there is a possibility of revamping for increased quantities but nowadays when that point is reached the parts, where possible, are vended. The proving of these jobs—having been accomplished in our departments—affords complete information to bidders, if desired. The vendor has the opportunity to use what he finds applicable to his equipment and many times can, with larger quantities than we have handled, manufacture more economically. Under the present conditions our automatic screw machines are devoted mostly to demonstrating new parts and materials, manufacturing those which have operations following of such a nature as to be safer if completed in their entirety in the plant and furnishing those which the supplier on account of some contingency is unable to do.

Effect of Newer Cutting Oils

The matter of cutting oils is now standardized into various mixtures for different materials and machines. Gone for the past ten years are the cans of white lead and oil previously mentioned. First came a high sulphurized base oil which was mixed with paraffin and engine oils and later, with special applications, a sulphur chlorinated one with paraffin dilutions. More uniformity in alloy steels with specifications calling for specific structure, grain size and reduction of area makes possible fairly consistent results in the number of pieces per tool grind. Super high-speed steels now show little variation. These factors make possible a workable modern time study system modified to our needs and all now help to make the designs of the Tool Engineer applicable to screw machines and turret lathes.

Aircraft Form Tools

Form tools being the most important ones used on screw machines let's turn our attention to them first. We prefer circular ones on single spindle automatic screw machines. We haven't found them practical on multiple spindle automatics on account of the rubbing action on side faces. On turret lathes, chucking machines and multiple spindle automatics either the tool bit type, longer plain base or dovetail flat form tools are used according to the quantities of parts to be made and types of holders available. Side clearances of one to three degrees are necessary. Top rake angles vary with the material but are necessary in most cases for smooth finishes. When it is necessary to change them on account of a sudden switch of material, below center grinding of affected sections furnishes a temporary solution but the type of finish so produced is generally unsatisfactory. The combination cutoff and form followed by the finish form method, where it can be used, produces good results on single spindle automatics and turret lathes. On multiples the use of a roughing tool followed by a finish form is preferred as being the most economical. Subjecting the rougher to the bulk of the removal of material and leaving the finisher from .005" to .008" on a side or face produces our best finishes and a minimum tool grinding. While in many shops the tool designer is able to give liberal tolerances on form tool dimensions in the interest of reducing tool cost, in our industry the closer the tools can be made within the limitations of modern equipment and attendant skill the greater the return, particularly if expensive grinding operations follow which take additional time due to variation in size.

Screw Machine, Deep Hole Drilling

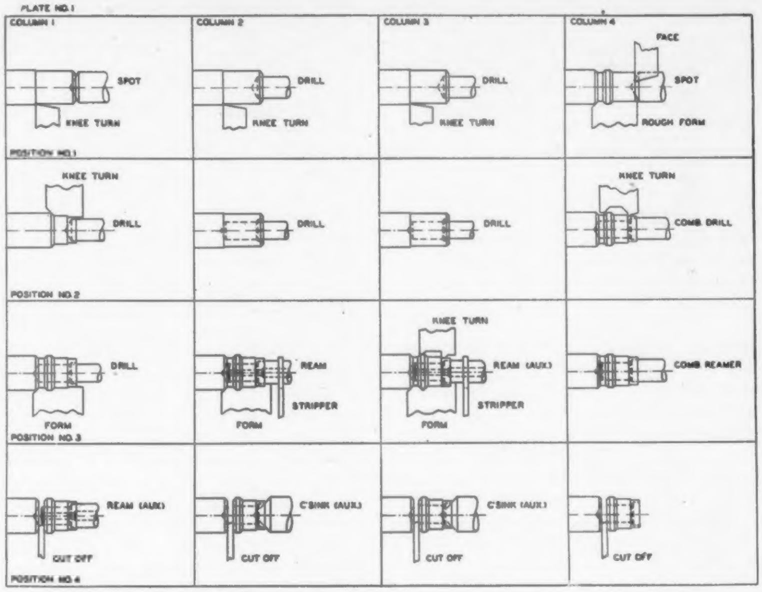
Deep hole drilling in automatic screw machines is a phase which required considerable experimenting despite experience outside of the aircraft engine industry. Ordinarily considerable runout in a drilled hole not visible to the eye has no significance unless it affects operations which follow. Highly stressed parts, however, cannot stand this. Our experience in alloy steels proves that the ordinary four and one half to six diameters used for the first poke of the drill in free machining materials does not work out. We have obtained our best results with three and one half diameters. Using this hole drilled as closely to size as possible makes a sort of guide bushing for the drills which follow. Heavy feeds applied to these drills produce long stiff curly chips but the drills do not stand up. Fine feeds

produce a type of chip which tends to wind itself around the drill to hinder the application of cutting oil applied at high pressure through small nozzles. Normal revolution for the revolving drills whirls the oil out of the flutes. It therefore becomes necessary to reduce the drill speed until the desired type of chip is obtained.

Tungsten carbide tipped tools for machining non-ferrous alloys when used on new types of machines have improved finishes and reduced costs. Our tool designers have become quite adept in their application to reamers, form, facing and cutoff tools.

The Madison type of reamer is used extensively in the reaming of unusual materials particularly when the holes are to be ground on later operations. They permit plenty of chip room and the introduction of the cutting agent. When we found they gave us trouble in deep hole reaming the logical thing was to introduce a means of getting oil under high pressure to the cutting edges and also assist in flushing out chips. This was accomplished by drilling a hole in the shank end to the adjusting pin, which was relieved of some of its bearing surface to permit the introduction of sufficient oil. Holes were drilled through the sides, near the cutting edges to meet this passage. The usual coupling was then made at the shank end with the oil supply. When tough stringy chips packed at the bottom of holes and wore out the ends of the reamer bodies, the latter were hardened and drawn at this point. Here is one example of an idea originating in the shop and then being passed on to the tool designer who makes necessary refinements and records it for other possible application.

PLATE NO. 1



Floating Socket Type Holders

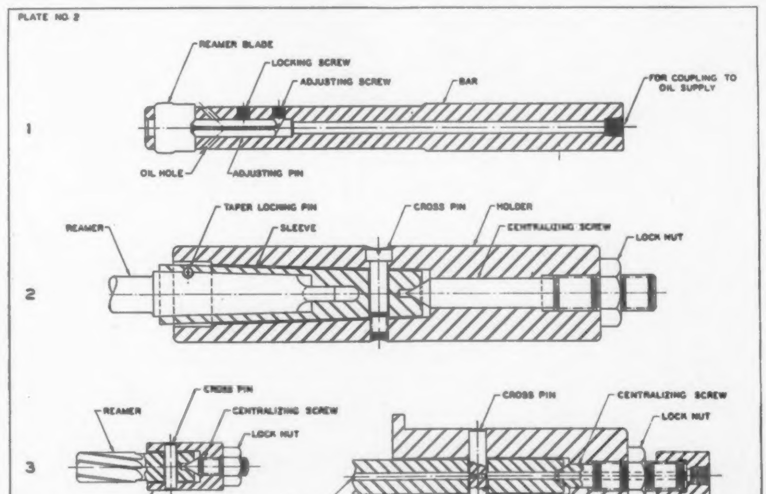
The floating socket type of reamer holder makes possible the use of standard taper shank type of reamers, is driven by cross pin and centralized by an adjustable screw which has a sixty degree included angle to fit the centre of the socket. This combination of reamer and holder is best suited where the quantities are not large.

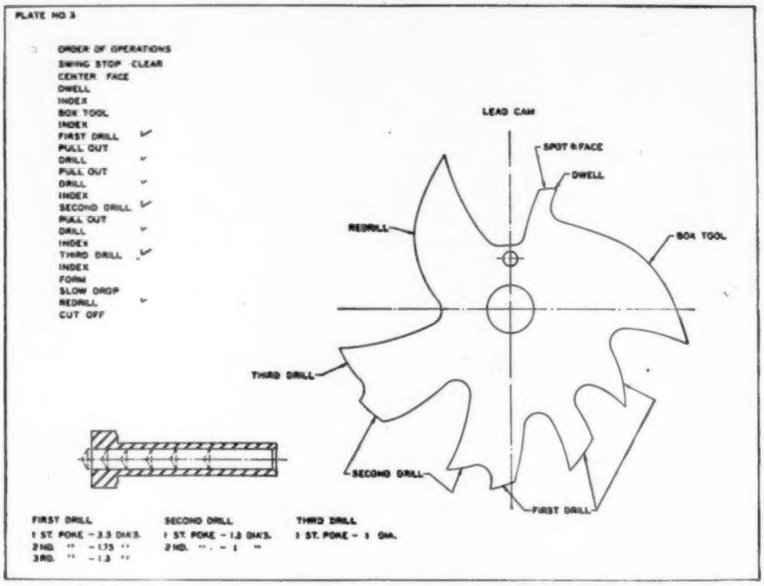
The stub type which we developed primarily for use on a single spindle automatic at practically the same time it was introduced as a catalogue item by a prominent small tool manufacturer has proved to be the most economical for large quantities. Consequently it has been applied to other types of turret lathes and screw machines. It also drives from a cross pin but is centralized directly in its own shank by the same type of adjusting screw mentioned in the previous paragraph.

Counterbores are avoided on automatics as much as possible because they are end-cutting, the type of tool which on alloy steel, produces the poorest finishes. The conventional pilot types are seldom used because of the danger of the pilot freezing to the chips in the hole which it enters. Where a pilot is necessary it is made an integral part of the tool with a non-cutting spiral flute circular ground. Chips which are not washed out of the hole by the cutting agent find their way into this flute or are pushed to the bottom of the hole where sufficient clearance must be allowed for them. On semi-automatic turret lathes where it has been found necessary due to the design of the part to use pilot counterbores, the material is of such a structure that little trouble is experienced. Swing tooling of shallow flat counterbored holes is a method of single tooling on automatics which produces the best finishes. On the turret lathes and universal hand screw machines the same results can be obtained by use of tool bits in the four-square turret on the cross slide provided the relation of the depth to the diameter of the tool is not too great. This actually amounts to skim cutting, referred to as a necessity during the World War, but at that time more on account of the variability of the material to be machined. Generally, hollow mills which are akin to counterbores are avoided where possible on account of their tendency to trap chips.

Cutting off tools of ordinary stock design cannot be used to good advantage because they are too frail and do not have the necessary parting angle. The latter on free machining materials

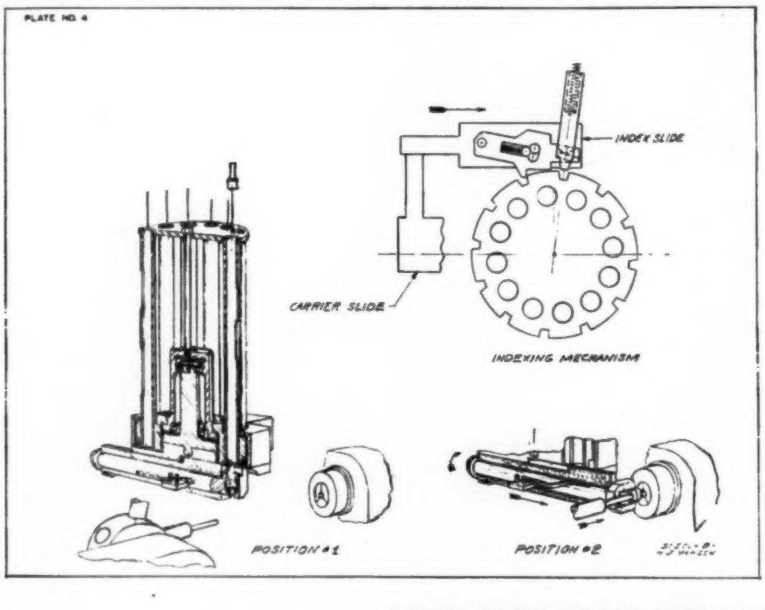
PLATE NO. 2





is normally from seventeen to twenty-three degrees. Except in special cases this angle has to be reduced to ten to twelve degrees and then becomes more or less of a form tool with respect to the amount of the feed which can be applied. Top rake and pressure angles are reduced as the hardness of the material increases. Excessive side clearances tend to convex or concave the cutoff side of the pieces being parted from the bar and leave deep drag marks when the tool is returned by a fast feed after the cut. It is not possible to state any definite amount of side clearance as this varies with the hardness and specifications.

Practically all the special alloy steels we use produce long stringy chips because they can hardly be termed free machining. These bulky chips then become a vital problem, where operators are required to run more than one machine and there is no economy in making chip pullers out of highly skilled and paid men. Therefore it takes a combination of properly designed tools, holders and their arrangement to make the showing desired. Too frequent tool grinding as the result of trying to make small chips doesn't fit in with a well applied time study system. In order to get sufficient chip room it is sometimes necessary to purchase machines of larger capacity than would be needed for free machining materials. This in turn increases investment because of the additional cost of larger tools and holders and other items not necessary to mention. The aircraft engine industry may yet reach the proportions that it will warrant the design of automatics suited to this chip problem.



It is essential to be familiar with past history in order that experiments previously and thoroughly made are not repeated in order to tool up parts on screw machines and turret lathes which apply under the conditions reviewed. The same consolidation of experience and achievement made in motor design is just as necessary in tool design and application to manufacturing.

Designing the Tools

Some of the essential things which our tool designers must know in order to make use of their designs are: familiarity with the various types of tool steels in order to specify them correctly for the material; understanding of the limitations of various makes of machines of the turret type in order to make use of bushings and tool holders to standard and special requirements; a knowledge of the machinability of various alloys in order to correctly determine the most efficient clearance angles and types of chips cut by various tools and their effect on setups. If they have a good working knowledge of all of these they can make themselves still more valuable if they can design cams and magazines suitable for the quantities involved.

It has often been said that screw machines are an ingenious Yankee invention. Time has proved that it does not require New Englanders alone to design tools for them. Ingenious men seem to be best suited for this purpose in our business, if they have the other necessary qualifications. Recently a statement appeared in a trade magazine to the effect that "twenty years ago there was a kind of fraternity among the men who actually operated the machines, making and designing the tools along with the actual operation of the machine itself." In our industry this condition actually existed as recently as ten years ago. I believe you'll understand by the history presented why this was so. Modern management, however, did not permit this condition to exist any longer than warranted.

This is an opportunity to express appreciation to those who have co-operated with us to make possible the small share contributed by "screw makers" as we are often called, in the advancement of aircraft engines and with your further help in Tool Engineering we'll try to do our bit to "make the air of tomorrow the safest transportation of the day."

Plate 1

This piece is a cylinder hold down nut blank and might be classed as an important small part because a gross of them are used per motor. It is manufactured from alloy steel hardened to Rockwell 26-32 scale "C."

The purpose of showing this plate is

to provide for discussion, a variety of arrangements of tools in two types of four-spindle automatic screw machines, one of which was manufactured in 1939, applicable to methods in columns one, two and three and the other made in 1926 to column four. The problem is one of getting away from chip traps, in order to make possible the operation of more than one machine.

These long, stringy chips have been previously mentioned as one of our handicaps. We won't complicate this with the matter of feeds or spindle speed although in the complete analysis they are both essential and would be best classified as "delayed strokes," in the words of the checker player.

In column number one we have a combination of tooling submitted by the engineers of a machine tool manufacturer. It was accepted for trial. A chip trap was encountered in positions number two and number three. Pieces occasionally broke off on the combination reamer in position number four, if the operator failed to get back to the machine at the "critical time" for grinding the cutoff tool.

In column number two we have a modification of the arrangement in column number one without changing feed or speed as a temporary but not satisfactory arrangement. A chip stripper has been added to partly eliminate the trap in position number three. This combination however, is one which by reason of so much forming, causes too much "down time" on the part of the operator for grinding this particular tool.

The abbreviation (Aux.) is auxiliary, meaning it can be fed by rapid traverse to within a few thousandths of the point where cutting action starts and returned rapidly after the cut without interfering with the normal action of the tool slide.

In column number four we show a combination on the 1926 model not arranged as originally planned but slightly modified by the operator on the job so as to require a minimum of chip pulling. Of the three outside diameters of the piece only the two end ones require smooth finishes. The center one is later milled hexagon.

After a study, of this job based on experiences of arrangements of tool combinations in columns number 1 and number 2 we now opine that there is a final solution in column number 3. What do you think?

Plate 2

On this slide we show a number of reamer holders mentioned in the text.

First: The Madison type with the arrangement for supplying cutting agent under pressure to the blade and materially assisting in flushing chips out of the hole. It is particularly effective for reaming piston pins and tappet guides, the former as a secondary operation and the latter a primary one; both performed on semi-automatic chucking machines. These parts have deep holes in relation to diameters and are heat treated and ground after reaming. The method of reaming with fluted reamers with oil holes was discarded because rejections of parts and reamer breakage were excessive.

Second: A holder which permits the use of "catalog" taper shank reamers (with machine tool limitations for overall length). You will notice that there is a taper pin locking this reamer to the socket to prevent the pulling out of the reamer in case the operator does not return to the machine at the critical time for regrinding of the tool.

The socket drives on the sixty degree angle centralizing screw and with the long bearing on the dowel, provides a precision method of reaming on screw machines and turret lathes if absolute concentricity of details is maintained.

The principle of driving by this method, nc doubt, was derived from reaming in an engine lathe. The old practice of our boyhood days was to place the shank center of a reamer in the tail stock center. A dog was attached to the shank to prevent its turning and the tool was screwed up to the hole and entered. Then we pulled the belt down by hand, threw the shifter over to engage the spindle and fed the reamer into the hole.

Third: We have the stub reamer with the similar principle. One distinct advantage is that it can be used in floating holders for alignment in a particular position on turrets of single spindle hand screws, turret lathes and semi-automatics.

Last: We have the idea of the stub reamer applied for use on multiple spindle automatics with the use of an oil hole, if necessary, incorporating the principle of the dowel centralizing screw in number two.

All of these have their particular applications depending on the type of machine, its limitations, condition, tolerance allowed and finish desired. The design can be modified to suit the new type of machines which we are purchasing.

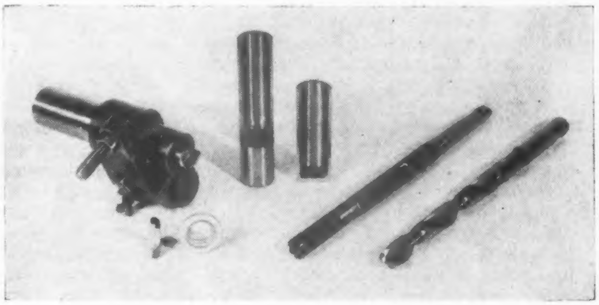
Plate 3

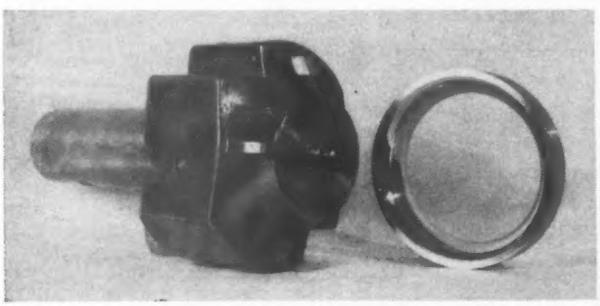
This slide shows: at the right, a lead cam used for deep hole drilling on a single spindle automatic screw machine; at the lower left, a section of the part produced illustrating the successive "pokes" of the three drills used; below it the number of drill diameters used for each "poke" and at the top left the order of operations required to make the part.

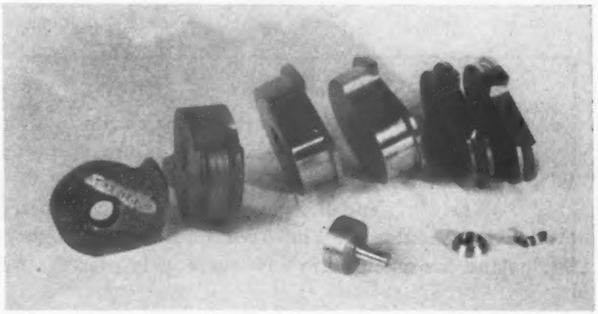
Each cam lobe is captioned with the

(Continued on page 72)

Right—Figure No. 5. Directly below—Figure No. 6. Right, below—Figure No. 7.







Tooling of Multiple Spindle Automatics

By C. C. STEVENS
MECHANICAL SUPERINTENDENT
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BRISTOL, CONNECTICUT

The selection of a multiple spindle machine for most economical production involves many factors—among them, the experience and preferences of the operating group in view of maintaining uniformity of equipment and interchangeability of tool holders and attachments within reasonable limits; the consideration of set-up time of one machine as compared to another; tool clearance; general accessibility; chip disposal; operator's skill and supervision requirements. Some operations are better performed on one type of machine than on another type; for example, threading operations requiring close lead tolerances will be better performed with lead screw control for the threading tools, and some machines feature such control as a part of the standard machine. Other considerations are the ease of changing cams and feeds, and the ability of the machine to operate at speeds suitable for using carbide tools, and maintaining close limits required in modern manufacturing.

The problem of maintaining close limits is minimized by the rigidity of tools; tool holders; slides; the machine base and probably securing rigidity of the spindles by the use of pre-loaded anti-friction bearings. The manufacturers of this equipment are meeting these requirements, and by making improvements which experience indicates are desirable from time to time are placing in the hands of Tool Engineers equipment that enables them to secure the high production desired. Each manufacturer has provided features in his machine which have distinct advantages from the operating, maintenance and tooling viewpoints for certain work. If this were not so, there would not be the need for making a selection from the various types of machines offered to industry.

Having made a tentative decision as to the type of machine; number of spindles, etc., to be used, the next step is to make a comparative analysis of the unit cost per piece produced; this analysis considers the initial cost of the machine; the yearly depreciation; the cost of tooling; the cost of operating—labor plus burden—the pieces per hour at the rate of efficiency in use at the plant concerned, which is usually 85 per cent, which is a 51 minute hour—adding the first four items and dividing this sum by the net pieces per hour gives the cost index per unit produced. It is to be noted that the operating cost —labor plus burden—may be more than for one operator, since these machines are often operated in multiple. This cost index when compared with similar factors for the group of machines under consideration readily indicates the machine to be used in respect to unit cost.

The Tool Engineer must thoroughly understand the machine to advantageously plan the tooling, as the operating cams are essentially a part of the tooling design and the various arrangements for imparting the motion from the control cams to the tool slide and cross slides are considerations in the tooling layout. These machines are made in 4-6 and 8 spindle types, and all are built essentially the same capacity ratings. They are powered from 7½ to 40 horsepower, depending on the material to be machined; the tools used, which may be either high speed steel or sintered carbide; these factors determine the speed of the machine and to a great extent the horsepower required.

Chucks

The chucks and chuck operating mechanism used on the chucking type of machine as regularly supplied by the machine builder fall under two general classifications—two and three jaw draw bar operating type; and two and three jaw face plate chucks. The two jaw chucks are usually used for irregular shapes requiring wide opening of the jaws. Occasionally, on chucking machines work can best be held by the collet type of chuck. There have been many designs of these chucks made, but all have been basically of the types mentioned. Chucks are hand operated by wrenches or power operated by power devices attached to the machine in proper position to serve the chuck, and in the case of the draw rod type of chuck, power is applied through an electric motor arrangement exerting pressure on the draw rod, or air or hydraulic cylinders placed at the rear end of the spindles. Chucking mechanisms have been developed utilizing spring pressure for the gripping power and mechanical means for releasing the spring pressure—such arrangements make use of the spool and finger mechanism carried on the rear extension of the work spindle, and is actuated by any one of the several means just described.

The bar type of multi-spindle automatic is most always supplied with the collet type of chuck, which can be fitted with adapters making them suitable for gripping odd shaped work or renewable in case of wear. Such chucks are operated by draw rod mechanism which is functioned as described earlier. Mechanism is provided for hand operation of the chucks to facilitate setting-up and testing.

Use of Auxiliaries

The Tool Engineer is greatly assisted in tooling automatic machines by being able to apply in many stations auxiliaries which permit of performing operations outside of the range of what might be considered normal. Such auxiliaries are—drill speeders, accelerated reamer attachments, threading attachments, revolving pick-off spindles, slotting and burring attachments, auxiliary tool slides, magazine and loading attachments, cross milling attachments, cross drilling attachments, pick-off and champering devices, and devices for marking the product. These attachments in many cases are independently driven. The above units used in conjunction with some ten or twelve basic operations for which the machines are designed, make it possible to tool these machines for a great variety of work for high production, and the tooling set-up may become very complicated.

Multiple Spindle Automatics

Standard types of tools for the basic operations of multiple spindle automatics include drills; reamers; cut-off tools; recessing tools; taps—solid and collapsing; threading dies—solid and self-opening die heads, with and without lead screw control; forming tools of a great variety—both flat and circular types. Variations from standard for these tools are often made for operations on certain materials and practices in various shops; such tools are secured in place by conventional means—bushings; holders; clamps, etc.

One method of holding circular form tools and adjusting them is by means of holes in the face of the tool, which

The types and sizes of machines coming within the classification of multiple spindle automatics are numerous. Considered here is the tooling of the larger machines of the bar type from 9/16" to 4¾", and the chucking type—those carrying 6" and 8" diameter chucks. The Tool Engineer must thoroughly understand the machine to advantageously plan the tooling.

engage a pin carried on a movable member which can be adjusted; in that manner controlling the position of the circular form tool. Another method of holding circular form tools is by a series of serrations on the face of the tool which match a corresponding set of serrations on an arm clamped against the tool; this arm being adjustable positioning the tool. Flat form tools are adjustable in the holders and clamped in positition. Often the tool holder is provided with micrometer adjustments, and on some makes of machines such adjustments are provided as a part of the tool slide. Drill speeders and accelerated reamer attachments are often provided to secure the correct R. P. M. for the diameter of drill or reamer and material to be machined, these attachments can be either standard as supplied by the machine manufacturer or special design as may be required by the user of the machine.

Lubricants

Cutting tool lubricants are made to many specifications and under many trade names. The lubricant will vary with the material machined, the types of tools used and somewhat with accepted practices of the automatic department. Detailed data on tool lubricants is available through the numerous distributors of this product.

All the foregoing is of concern to the Tool Engineer in making his tooling layout—it is not the purpose of this paper to discuss feeds and speeds in detail for machining various materials as practice varies with organizations, and the manufacturer of the equipment will recommend feeds and speeds that experience with his type of machine indicates as being proper.

Also, the various suppliers of high speed steels and sintered carbide have prepared similar data for using their material.

Tabulation of data of the amount of stock removed per minute, and power requirements on multiple spindle automatics with proper tooling on various materials is of use to the Tool Engineer and is condusive to a better understanding of the performance of the machines and tools; such performance data can be readily secured for the overall performance of a machine, and this performance of the machines and tools can be further broken down into performance of one set of tools or a tool, and the overall efficiency of the machine can be readily determined. An example of such data will be given.—The machining of high carbon chrome steel, SAE 52100—having a Brinell of approximately 180, when machined on a representative 6-spindle automatic using a full complement of high speed steel tools operating with efficient feeds and speeds on a forging 2 7/8" O. D. x 1 7/32" lg. having a formed bore of 2 3/8" mean diameter—removes stock at the rate of 3.77 cubic inches per minute, absorbing a total of fifteen horsepower of which over ten horsepower is consumed by the tools. In this operation there are employed a total of nine tools, some of which are roughing and finishing tools. They are:—O. D. turning; face & Chamfering; two lip bore tools; roughing and finishing reamers; a rough form tool and a finish form tool. The use of sintered carbide tools would probably double the amount of stock removed per minute and greatly increase the power requirements.

Now we will review some of the features and characteristics of several representative makes of multiple spindle automatics. While this paper was purposely limited in the range of machines coming under this general classification, an attempt has been made to cover the field as broadly as possible; however, there are two makes of machines which have not entered into this talk—the line built by the Cleveland Automatic Machine Company, Cleveland, Ohio, on which there was no data available at this time for this paper, and the other machine is the Baird horizontal chucking machine, which has a capacity between centers of chucks of 7½" and is a six spindle machine having many features which gives its a proper place in the chucking machine field.

Each make of machine has outstanding features and all makes have features in common such as, various means of operating the chucks; chip conveyors; double indexing, and the application of numerous attachments. It is not the intent of this paper to make comparison of one type of machine to another, but to point out features that are outstanding for each make of machine. This will be done directly by the means of suitable slides and short discussion.

Goss & DeLeeuw Tool Rotating and Work Rotating Chucking Machines

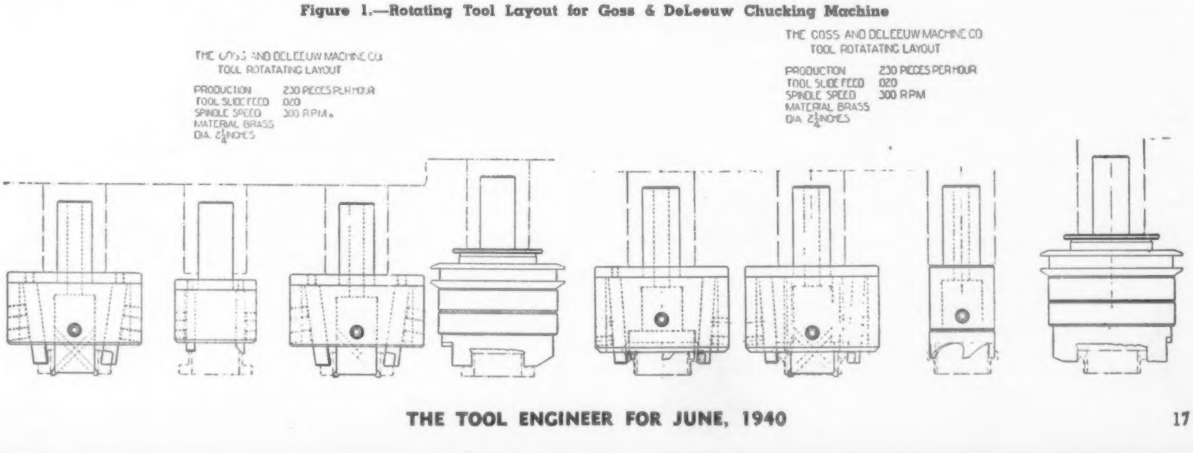
The machines made by the Goss & DeLeeuw Machine Co., New Britain, Conn., are of two types—the tool rotating type, and the work rotating type. The tool roating types are made in two and four spindle machines, powered from five to twenty horsepower, and are from 6" to 11" center to center of the spindles, mounting rectangular type chucks 8¼" to 14½" long; they weigh from 5,200 to 16,000 pounds each. The production cycle is from 20 minimum to 720 maximum per hour. The 6" x 6¾" machine is built in a high speed spindle—vee belt drive model for using carbide tools, and has spindle speeds from 1,000 to 3,600 R.P.M.

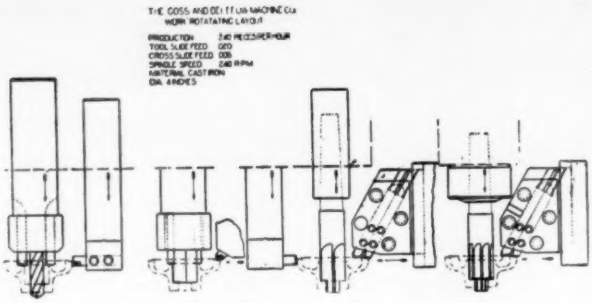
The work rotating type of these machines is made in 4, 5, 6 and 8 spindle types; powered from ten to twenty horsepower, mounting from 6" to 10" chucks, they weigh from 24,000 to 26,000 pounds each. The production cycle of these machines is from 18 minimum to 500 maximum per hour.

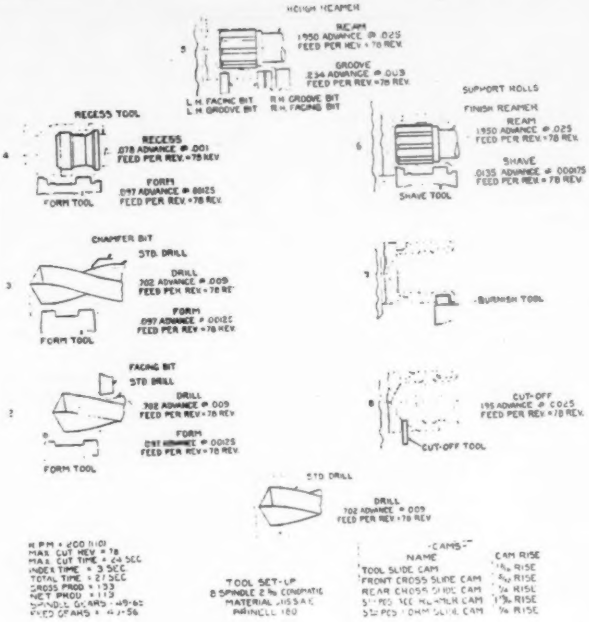
Spindles on the work rotating type machines are driven by positive dog clutches which engage and disengage while spindles are practically stationary.

Both types of machines feature lead screw control. The lead screw unit is readily accessible and easily changed from one pitch to another. Through telescopic spindles two lead screws, each with different leads, can be used for internal and external threading simultaneously. Reversing motor drive for threading standard equipment, and this feature for multi-spindle machines was first introduced on the Goss & DeLeeuw. Turret clamping is through a split ring—the face plate being clamped to the opposite side of the "vee," which is integral with the housing; this relieves the locking bolt of any functioning, excepting positioning of the face plate.

Figure 1.—Rotating Tool Layout for Goss & DeLeeuw Chucking Machine







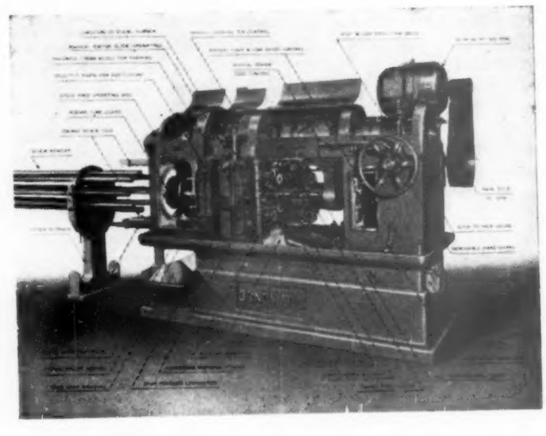
Cone Automatics

The cone automatics are made in three types. The four spindle automatics are bar machines with spindles placed vertically one above the other, and are made in four sizes, from 1" to 2⅝". There are two cross slides on this type of machine one opposite the other, each carrying all the tools for its side of the machine. The drill and tool holder is mounted in the usual manner directly ahead of the collets and advances toward the work, carrying all tools forward in one motion. This type of machine completes a part on each spindle during its cycle, resulting in the production of four completed parts in each cycle of the machine.

The four spindle machines of the horizontal type are made in the bar type in ten sizes—from ⅞" to 6" bar sizes. The six and eight spindle horizontal machines are made in five sizes—from 1¼" to 2⅝" bar sizes, and are extremely rugged machines and as is common with all machines of this manufacturer, the camshaft and cams are mounted overhead out of the way of the chips; the overhead structure permits of rigid construction. These machines feature solid tool slides carried on opposite sides of the machine, as is the case with the four spindle vertical machine. This construction gives especially strong tool slides, minimizing number of wearing surfaces and parts. They are operated independently of each other by separate cams on the drum shaft.

Another feature of the cone automatics is the universal slide, adding another cross slide to the machine making it capable of producing extra operations, such as—taper undercutting, back facing, necking, etc. Provision is made for a wide range of angle adjustments.

Above—Figure 2. Right — Tool set-up for Cone Automatics, Figure 3.

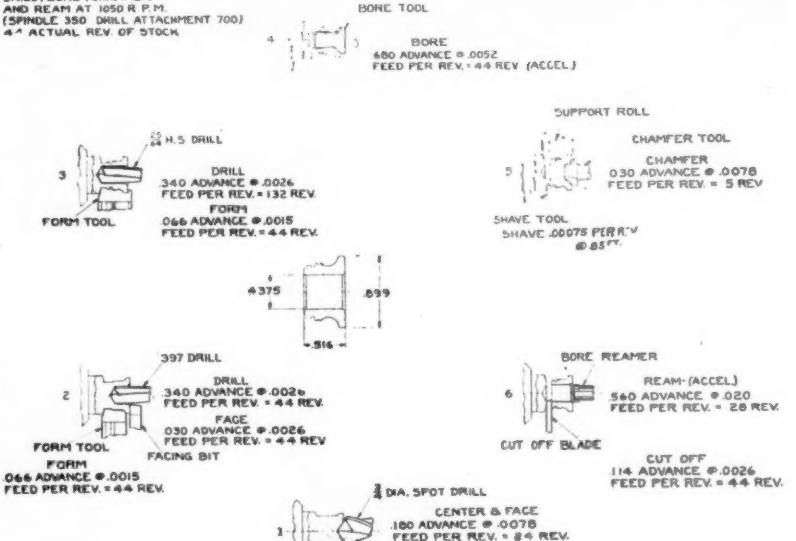


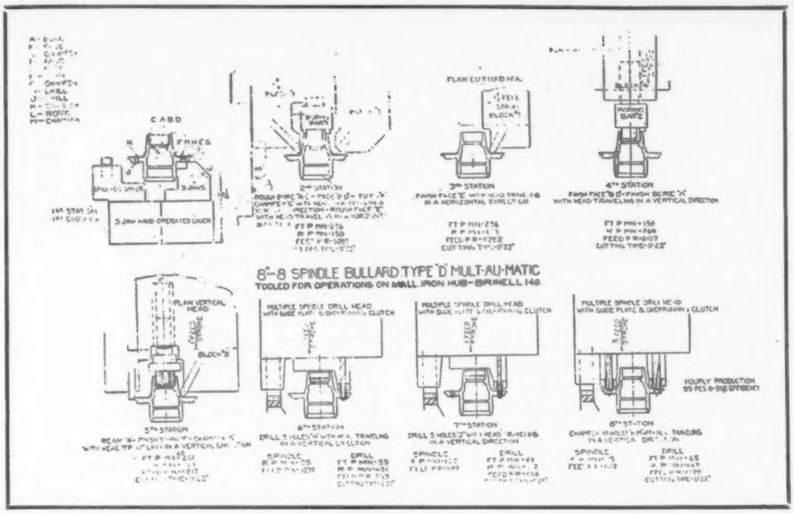
Right — 2⅝" Spindle "Cono-Matic."

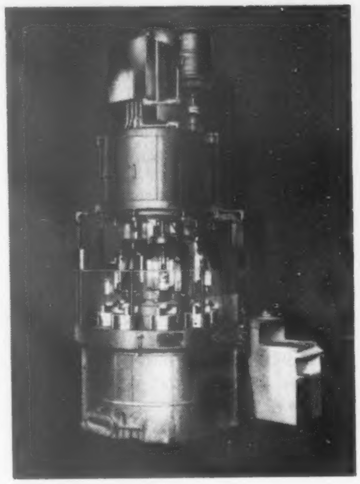
Below — Tool set-up for Greenlee Automatic. Figure 4.

Greenlee Automatics

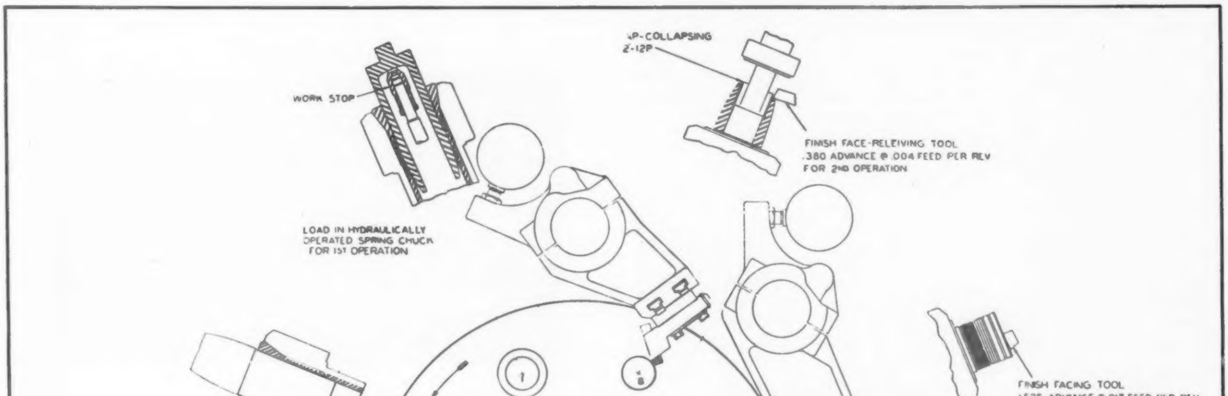
Greenlee automatics are of the bar type and are made in the four and six spindle type from ⅞" to 2⅝" (making nine sizes) and in the six spindle type, five sizes, from 1" to 2" capacity. These machines are entirely open on the top side, which is one feature of their design which makes for accessibility of tools. Another feature of the machine is the ease of changing the cross slide cams which are so placed as to give independent movement of the forming slides. The main tool slide is of an inverted "T" construction and is operated through an intermittent gear carried between the ways; this gear meshes with a rack bolted directly against the bottom of the slide to carry







Above—Tooling for Bullard automatic, as described by the author, Figure No. 5. Above right—Showing a Bullard 6 spindle Type "J". Below showing tooling described by the author on Model 86 New Britain 8 spindle automatic chucker—tooled for machining 75 mm. shell forging.



it forward. The return of the tool slide is by means of another set of teeth on the same gear, which meshes with another rack suspended below the gear by a heavy arm from the bottom of the tool slide. This design eliminates all tool slide cams, and the time required for changing them on various set-ups.

The stock feeds and collet mechanism are operated from a cam drum located at the rear of the spindle carrier.

Bullard Automatics

Bullard multiple spindle automatics differ from other machines in this respect, that the spindles are in a vertical plane. They are of the chucking type and are made in six and eight spindle sizes, carrying chucks from 7⅜" to 18⅜" in diameter, and are known as type J-7, J-11 and type "D" mult-au-matics, and in the larger sizes, with the exception of the "conomatics" of the largest size, are the heaviest machines coming in the classification under consideration, weighing up to 40,000 pounds.

These machines feature independent feed for each station as required, both vertical and horizontal, and the rate is independent and variable for each tooling head.

Among the many unusual features of this machine is the arrangement whereby power is delivered to the work spindles only in their operating position. This is accomplished by means of the spindle driving gear rolling into mesh with its driver upon entering the station.

The machine being circular requires the minimum of floor space for its size range.

Many interesting toolings of these machines have been made; such as turning operations on shafts, assembling bushing in position on the machine and completing machining operations after such assembly.

Acme-Gridley Automatics

The Acme-Gridley line of automatics is made in 4, 6 and 8 spindle machines of the bar and chucking types. Eleven sizes from 9/16" to 4¾" bar sizes and from 6" to 10" diameter chucks in the chucking type.

Features characteristic of these machines are the independently controlled

(Continued on page 70)

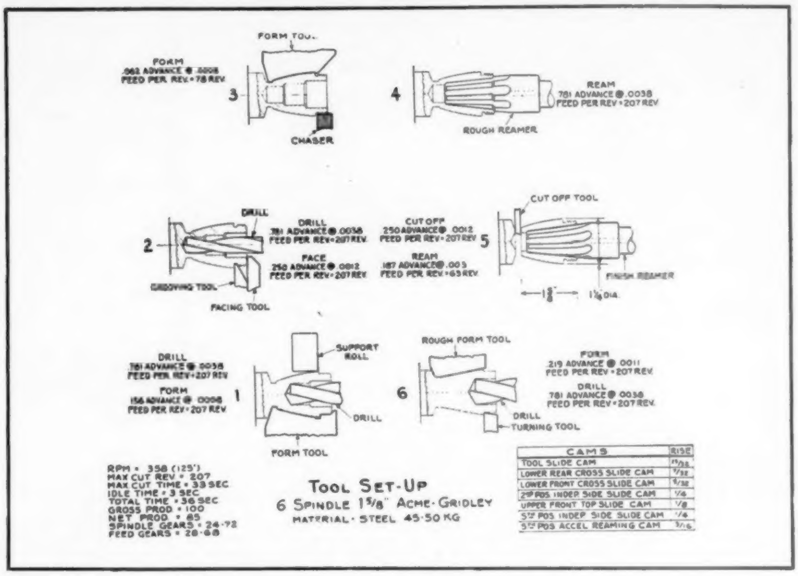
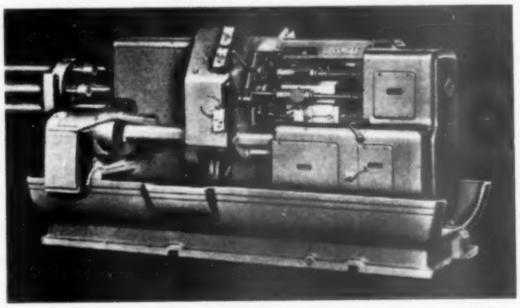
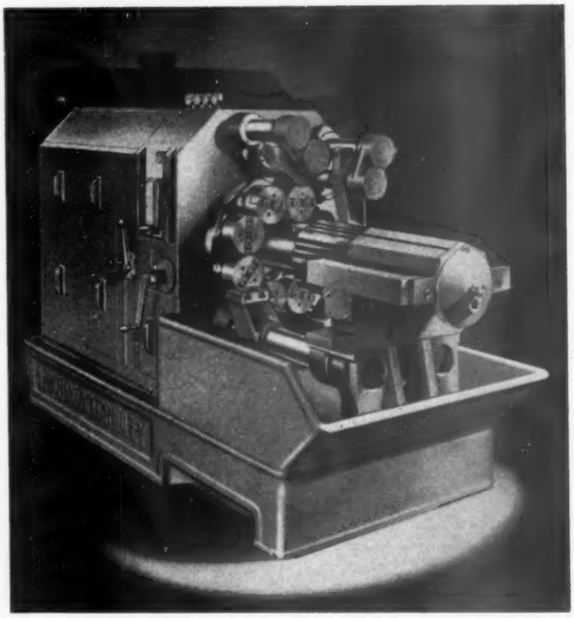


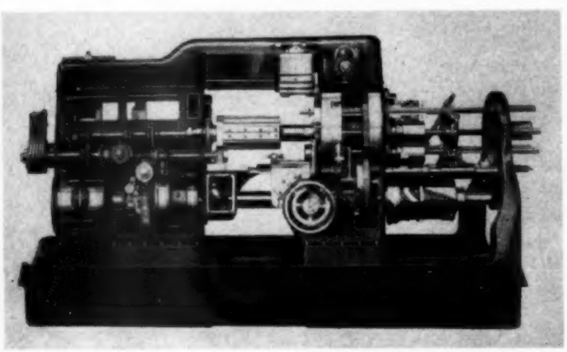
Figure 6.



Right—Greenlee 1"—6 Spindle Automatic.



Right — Model 86 — New Britain Gridley 8 Spindle Automatic Chucking Machine.



Below — Acme-Gridley Model "R.J."

Small Lot Production on Turret Lathes

Today it becomes the responsibility of the Tool Engineer to meet increased production requirements and higher engineering standards of quality. Among the problems he must solve are tooling for limited production and the reduction of lost time.

By L. B. GILBERT
TIME AND METHODS DEPARTMENT
COLUMBUS-McKINNON CHAIN CORP.
TONAWANDA, N.Y.

IT is, indeed, a privilege to those of us who have an interest in the development and application of screw machines and their tooling, to have had the opportunity of carrying away from this meeting in our minds, new ideas, and, perhaps, ideas that will contribute to the solution of perplexing problems that exist or may exist in our own work. These ideas have been presented by "application engineers"—men whose responsibilities lie, not in the development of the particular machines directly, but in the tooling and application of these machines to insure the best possible results in quality and production.

Many of us realize today that, as increased production requirements and higher engineering standards of quality must be faced, it becomes the responsibility of the Tool Engineer to meet and overcome these seemingly impossible problems. And, because these obligations are being met daily with so little said concerning the method of fulfillment, we are fortunate in having heard the papers presented, and for the opportunity of joining the discussions to follow.

Because of necessity, it was denied me the privilege of obtaining pre-prints on two of the papers presented, I must rely upon notes taken during the talks to attempt to bring out the important items touched upon. As it is realized that these may reflect my personal interest in the subjects, your Chairman and speakers earnestly encourage your questions and participation in the discussions, remembering that by so doing, others of us at this meeting may be further benefited.

Forming Tools

The subject of forming tools is one on which all too little has been written or said. It is a method of tooling which a number of the low production shops have been reluctant to adopt, possibly because of cost or perhaps that past trials have not been too satisfactory, and so it was felt that it was for the high production jobs only, and was dropped.

But with the improvements and added rigidity built into the machines, more and more of these shops have come to recognize that the form tools, where properly designed, play a very important role in economical production.

And so we must feel fortunate in having a man who has studied and learned so much about the subject, as Mr. Berry has and who has favored us with instructive thoughts concerning it.

Tooling Aircraft Engines

Mr. Taylor, in his paper and slides on "Tooling for Aircraft Engines" has given us an interesting review of the past and present methods of screw machine tooling employed in that great industry.

As he told us, there are many phases of Tool Engineering peculiar to that business alone. No one can dispute that statement. It is equally true, however, that pretty nearly every business has its own particular problems, which must be met, but still there remains a host of common problems which every engineer dealing with this subject must face.

He, also, brings out that by the standardizations on cutting oils and more uniformity in the alloy steels and cutting materials has made for consistency in the number of pieces per grind to the extent that a timestudy system was workable. Being a timestudy man myself, the significance of this statement brings out the fact that had not the progress of this standardization been made by the different contributing agencies, it would not only be difficult to apply timestudy, but the manufacturing requirements of today would be impossible.

The reference to the design and application of various cutting tools in machining the tougher alloy steels will be of special value to those of us who are now, perhaps, finding difficulties in applying our machines and tools to the processing of these materials.

Tooling Automatics

In his paper and slides on "Tooling of Multi-Spindle Automatics," Mr. Stevens has shown a very thorough knowledge of his subject and has covered a tremendous amount of ground on the subject. Not only will his clear presentation of the types of machines, attachments, and applications of the various cutting tools be of value to the users of this type of equipment, but the factors brought out in the selection of the machines for the work to be produced will undoubtedly aid production engineers and managers in the purchase of their equipment. For the reason that this is a study within itself mostly limited to the high production plants, and realizing my inability to add anything of value to the items already discussed, I will leave it to the questions which Mr. Stevens will gladly answer, to possibly bring out further points.

Tooling for Limited Production

Let us deviate, for the moment, from the specific applications of screw machine tooling, that have been so well presented, to another phase of this broad subject, the problems encountered in the smaller and medium-sized shops where a large variety of work and materials are processed over a limited number of hand screw machines or turret lathes. The lot sizes vary from a few pieces for special jobs to sizable stock runs.

In a large number of plants today the production requirements are extremely high, which gives to the smaller shops, faced with the conditions mentioned, some very difficult production problems. As the turret lathe has become one of the most versatile and economically productive tools in our plants, costs and production requirements prohibit re-routing the jobs over slower and more costly equipment; and so it becomes a problem for the Tool Engineer, the Time Study Engineer, and Foreman to reduce the lost times and to obtain the highest productive efficiency of the machines.

It is not my intention to bore you by bringing into this discussion solution of common problems with which so many of you are familiar, but to contribute some helpful ideas that may be of benefit to a few.

Reducing Lost Time

The first problem is reduction of lost time, which might be defined as all non-cutting time, i.e., non-productive time involved by set-ups, cutting tool maintenance, loading and unloading the work, checking, etc. As mentioned by one of our speakers, the machine manufacturers have aided us to a great extent in reducing our set-ups by providing a variety of standard adjustable tool holders and attachments, with which we may equip our machines, but the application of these devices must be worked out by the individual users. Set-ups generally consist of three major items: (1) the changeover of the

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INDUSTRIAL REQUIREMENTS in Tool Engineering Education

By CLIFFORD S. STILWELL
EXECUTIVE VICE PRESIDENT
WARNER & SWASEY COMPANY
CLEVELAND, OHIO

IT probably would be foolhardy for me to define what industry demands in education for the Tool Engineer by cataloging a curricular program. I shall, therefore, leave that phase of the discussion to others entirely, with but one suggestion coming out of my own experience with engineers.

I think the subject of English is a highly important fundamental in engineering. In this country where we have very limited contact with any language other than our own, we fail to realize with what inadequacy we express ourselves to each other. Business and professional contacts among men are largely in the nature of exchanging ideas and the degree to which these ideas are clearly expressed is a very important element in an engineer's performance. So much for curriculum.

Philosophy of the Tool Engineer

What I should like to make the burden of my few remarks verges on the philosophical, but to me a most fundamental part of an engineering education. Because of the very temperament of an engineering mind, I am apprehensive that what I say here may not altogether intrigue your thinking, but that very possibility marks the importance of some basic thought in the minds of our candidates for Tool Engineering.

The Tool Engineer must approach his task with a sound conception of his opportunity as an individual. The worldwide conflict of social philosophies has so confused our thought that it has had a very definite effect on the efficiency of performance of all of us as individuals. The Tool Engineer is promoting all the elements of a mechanized civilization and if he is to follow this career he must certainly be convinced of the validity of his objective. I speak of this now because I am definitely impressed that as young men seek positions in industry either as graduates of universities or from technical high schools they present themselves in an attitude of mind which definitely handicaps their progress. They seem to feel that they are somehow victims of a system; that beyond some limited initiative on their part, their problem properly falls on the shoulders of the community and that their welfare will inevitably be provided. Altogether too many students flood from our schools and colleges convinced that someone owes them something. What we need is more people obsessed with a purpose to serve and not to be served.

Competition vs. Paternalism

One of the greatest tragedies in our current political philosophy is an implied paternalism which suggests a man deliver a fair day's effort and that nothing more is required of him. The competitive system which commands success requires that a man deliver all he has and that is never more than enough. No engineering law is any sounder than, "the value of results depends upon the volume and quality of production whether man or machine." I speak of this general idea because I regard it as absolutely fundamental to all education. Sound thinking in this direction must begin in the mind of the teacher and sad though it be there is evidence to the effect that some questioning of the principle of individualism has permeated the teacher as well as the student.

Imagination a Necessary Requisite

The next element in the makeup of our Tool Engineer which seems to me of prime importance is that education

Detroit, Michigan

To the Editor,

I was unable to attend the Annual meeting in New York, but being on the Educational Committee, and Historical Committee, have read with great interest the address of our past president Mr. Weaver and also the letter from Professor John Younger commenting on Mr. Weaver's speech, both of which were printed in the April issue of "The Tool Engineer."

My personal opinion (not as a committeeman) is that both of these men are just a little in error in some respects. First, Mr. Weaver leaves the impression that no colleges are now teaching Tool Engineering. It is with this impression that Professor Younger takes issue. I would agree with Professor Younger on this point, for I know of one college which has been teaching a full course in Tool Engineering for more than ten years and has it listed in its catalog as "Tool Engineering."

Professor Younger says in his letter that the Ohio State University has been teaching it for some time under the name of "Industrial Engineering." I take issue mildly with Professor Younger (I say "mildly" for I know John Younger too well to not be mild about it) when he indicates an industrial engineering course offers the kind of training Tool Engineers require.

All industrial engineering courses cover many of the subjects which any Tool Engineering course should embrace, but I would not hire a graduate from any of these institutions with the expectation that he could do Tool Engineering. In the positions I have held in industry where it was my responsibility to employ men for the Tool Engineering department I learned that the industrial engineering graduate is not a good gamble even for employment as a tool designer, unless I had means available for giving him a thorough apprenticeship training.

I do not mean this as an indictment of industrial engineering. In a mechanical engineering course the student studies drafting and chemistry but upon graduation is not a draftsman nor a chemist—and that's no reflection upon the wisdom of the curriculum compounders or of the methods or equipment of instruction. These and other subjects are essential as background for the engineering graduate.

It has been our experience at the Detroit College of Applied Science, covering 15 years, that it takes from 900 to 1000 hours to train a carefully selected student so that he will be capable of holding a job in industry as a tool designer. By "carefully selected" I mean this: over a third of our students have had college or university training in engineering before beginning our training. The majority of the other two thirds have had tool making or similar experience. The average age of all our students is 28½ years, and all must have had at least 400 hours of mechanical drafting training before starting our tool designing course. We feel that after their graduation from this school that we have merely helped them over the threshold into a tool designing department where they will have to be content with the minimum wage and amenable to many suggestions.

I believe that both Mr. Weaver and Professor Younger will agree with me that it is not just the name or contents of the course that's significant, but rather the thoroughness and the duration of the courses that matter. I may have been an engineer upon graduation but I soon learned that I certainly was not a draftsman nor a chemist.

Industry does not expect a finished product from any educational institution but does not have, except in rare instances, facilities for proper apprenticeship training and in general is—in my opinion—entitled to a more specifically trained individual than than it is now receiving from the educational institutions its taxes help to support. Should not the student immediately upon graduating have a right to definite assurance of an ability to perform at least one engineering function in a manner acceptable to industry? Might it not be more advantageous both to industry and the student if an engineering college with a thousand engineering students were to insist upon a higher degree of specialization by grouping 100 of them for 4 years of just Tool Designing and another 100 for Tool Engineering, and so on, in recognition of industry's inability to provide apprenticeships for all engineering graduates?

The records of the American Society of Tool Engineers reveal that it must require considerable intelligence for a graduate mechanical, civil, electrical, chemical or industrial engineer to adapt himself to Tool Engineering, for the percentage of its membership who are graduate engineers is comparatively small. The best, and the majority, of Tool Engineers in this land are its members.

Hoping for a closer cooperation between industry, the colleges and the American Society of Tool Engineers, I am,

Yours truly

O. B. Jones

Detroit College of Applied Science

deal specifically with the development of his imagination. A moment ago when discussing the definition of an engineer I stopped with Webster's description of an engineer as a "successful manager" and a manager deals essentially with ideas, not with things. He is in a real sense a creator and a creator needs an imagination.

He needs first a faith in the theory of American mass production and an imagination which helps him visualize the service of mass production to society through "more goods for more people."

Thomas Edison has always been my classic example of a great imagination. The familiar story of his invention of the storage battery is a perfect illustration. As I recall the story he conducted some ten thousand independent experiments before he obtained any hopeful result. I have often wondered what driving force could have kept Edison stubbornly after this objective had he not had an imagination which enabled him to dream of what success would mean either for himself or for the world.

Lack of imagination is one of the great handicaps which management encounters constantly in organization and particularly in all the branches of engineering, engineering of design, of production and of sales. I discussed only within a matter of days some greatly enlarged responsibilities for which it was almost imperative that two or three men be selected from an engineering department. Careful canvass was made of the entire group of one hundred men, revealing not a single candidate who could assume the larger task simply because of lack of imagination and an ability to work effectively with other men.

The "Slide Rule" a Hindrance

Figuratively speaking, one of the engineer's greatest handicaps to his development is his slide rule. Education must somehow develop a form of thinking which gets away from the idea that the solution of every problem lies somewhere in a formula or on a "slip stick."

As we progress in engineering methods, it is important that the engineer increasingly apply himself to the idea of lower cost and greater production with new combinations created of the material of thoroughly established fundamental method.

Education—Vestibule to Career of Service

If what I have discussed thus far sounds like platitudes I can say to you very sincerely that it arises directly from the difficulty which I have experienced in trying to find men from engineering groups who could assume broader responsibility. Before I leave this thought and in our general discussion of engineering education, I quarrel somewhat with the modern tendency to emphasize the commercial phase of education, to put a dollar sign on it. I realize fully that in our factory apprentice system, in the vocational training school and, to a lesser degree, in the technical high school, the objective is to enable the student to make a living, but altogether too many people look upon an education as something to be cashed in on rather than as a vestibule to a career of service. We have become so involved in a material civilization that we are rapidly accepting a "gimme" complex at the cost of all which makes for deepest satisfaction through a contribution to society rather than a collection from it.

Vocational Guidance Needed

The next element of education which it seems to me has been insufficiently emphasized is the subject of vocational guidance, beginning, perhaps, with the formative high school years and continuing constantly through the university. I readily admit substantial progress in this direction as compared with a generation ago, but I do not believe that the importance of constant counsel with the student has yet reached the degree of importance in the educator's mind that it some day must have.

This thought may inspire only criticism from the educator who is already bowed down with the elaboration of specialization in school training. The curricula of our high schools and colleges have been tremendously burdened in thirty years through the introduction of long lists of electives or marginal courses in an effort to provide intensive education for given lines of endeavor. The products of our schools it seems to me could be greatly improved if, in this process of increasing specialization, there could be more certainty of direction of the student toward his field of greatest aptitude before he finds himself on the threshold of business and his school years gone.

I was impressed recently in investigating the system in a given school where each student was obliged to spend periodically an hour alone with an assigned teacher, throughout his course, until such time as he could thoroughly crystallize in his own mind whatever objective he sought in later life. It is a method, perhaps, beyond the practical phase of public school systems, but, nevertheless, an ideal to be sought for.

As a part of the general subject of vocational guidance, there is a good deal of value in cultivating more contact with business during the school years. There ought to be frequent contacts of business men either with clinical groups or large assemblies in all our schools and I am sure there are large numbers of business and professional men who would willingly contribute toward this subject of vocational guidance by conference and discussion, if such assistance were sought from the educator's side.

The demand for education in this country has increased by such tremendous bounds in the last generation that its limitation of student body must inevitably be selective, and desirably so, but if, as a part of this process, the general subject of vocational guidance might have some better relation to a pure academic rating, I believe we could bring our Tool Engineering candidate into industry or up through industry much more effectively.

The Humanities

I pass now to a broad observation which ties closely to the matter of vocational guidance and to what is known in general education as the humanities. Vague though the term may be to you as engineers, there seems to be no single element in the makeup of the Tool Engineer's qualifications more important to his effective performance than his ability to deal with people both cooperatively and in leadership. After all, no problem in the production industries is more vital than the problem of people. The most successful Tool Engineering is done with people. A most perfect conception by the Tool Engineer in the form of ideas, method or technique remains only an idea if, as a part of the process, the Tool Engineer cannot convince first his superiors and then the producers, of the validity of his scheme.

Because I began and spent a large part of my active life as a salesman I like to describe this process as selling, not in selling the product, but by selling one's self and one's thought. The process goes on day in and day out in every department of an industrial enterprise.

Education Should Develop Personality

To particularize a little further, I believe that education ought to give a better rating to personality. I suggested a moment ago the necessary selectivity in all forms of student training and our educators have generally accepted the measure of academic rating through scholarship or I.Q. tests. I presume if we could explore ths history of school honor societies such as Phi Beta Kappa or the engineer's Tau Beta Pi, that we should find the average record of success favorable to these groups, but I am convinced that such rank is by no means an open sesame to success. The paradox of my own company's history is perhaps, a fair illustration of this statement.

The Warner and Swasey Company is a concern naturally reputed to be an engineering enterprise and, particularly so to the lay mind, because of its work

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UNIVERSITY VIEWPOINT of Tool Engineering Education

By J. W. BARKER

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ENGINEERING education has gone through — in this country, at least —a number of phases. At one time back in the '80's and '90's it was dedicated very largely to preparation for the initial job that the engineer might have upon graduation. Then, as industry became more and more specialized in the early 1900's engineering education likewise became more and more specialized and we saw the growth of the 57 different varieties of engineering education which Mr. Stilwell mentioned.

It has gone through that phase and it has for the last 15 to 20 years been swinging back. I believe I am correct in saying that no engineering educator in the United States today believes that in a four-year period after graduation from high school is it possible to take a young man and give to him all of the aspects of education which will include preparation for his first job, which will include a background in the humanities and the social sciences, which will include a command of the English language, which will include a command of the theory of engineering and of the specialized engineering which is necessary for any particular area.

I have been laboring for the last year on a special committee of engineering education which has to do with the aim and scope of the engineering program. That report, like this one on turret work, will shortly come from the press. That report covers precisely the points that Mr. Stilwell mentioned. It points to the challenges which are being handed to education in this mechanistic civilization in which we are living. It says that running through the four-year basic program of engineering education there must be two main stems: One, the scientific-technological, which is its foundation, and running parallel with and integrated with it, there must be a stem of instruction in the social sciences and humanities which is dedicated to making the scientific-technological stem fit into this mechanistic civilization in which we are living.

One of the problems of the engineering educator is to sell that to you and also to his students. Engineering students are probably the most pragmatic individuals there are in the United States. If they cannot see a reason for a course in an engineering program they give to it as little attention as the professor will let them get away with.

On the other side, the engineering teachers themselves are probably the world's worst time robbers. They will hand to a student a home assignment which even they themselves as professors couldn't do in twice the time that the student has available for it. And then they will mark the student on how much of that he does.

Stop and think! If we as educators are going to do what Mr. Stilwell suggested, inculcate in these boys some concept of this civilization in which we are living, how it came to be, where it is, where it is headed, and on the other hand our own engineering colleagues are overloading them to the point where they are on the verge of a breakdown, how are we going to get this less tangible kind of thing, this teaching of civilization in the evening across to them, when confronted with a definitive homework problem on which there is an answer, "Did he do it or didn't he do it?" You have the conflict of the bull session type of course versus the very definitive scientific and technical course.

Many have the opinion that the only way to get that across to engineering students is to abandon the concept of individual courses in history, philosophy, social science, and so forth, and to take one theme, and one only, that I have mentioned in this talk before, "How did this civilization in which we are now living come to be the way it is? What are the foments that are working in that civilization today, and where is it apt to go?"

That kind of a program of the social humanistic type you can sell to a pragmatic student. And, gentlemen, the engineering educator has to be a salesman. He has to sell his product to the student, and then he has the even tougher job of selling his product, the student, to you.

To get back to what I had originally written on this paper, I was confronted with the same problem Mr. Stilwell was: What is a definition of Tool Engineering?

Functions of the Tool Engineer

In this paper the scope of Tool Engineering is considered to include the functions of:

1. Jig and fixture design.
2. The design of special cutting tools, dies and molds.
3. The design of special machines and other equipment for the use of the manufacturing department.
4. Construction of the foregoing three classes of equipment.
5. Selection (for purchase) of machines and standard tools for the plant.
6. Installation of machines and plant equipment.
7. Maintenance of all machine and tools in the plant.

Inasmuch as the manufacturing cost of a product depends to a great extent upon the various phases of Tool Engineering, this obviously is one of the very important functions relating to production. In addition, Tool Engineering is a factor which influences the quality of the manufactured products, service to the customer (i.e., interchangeability of machine parts), and industrial safety (which depnds upon the design and selection of safe machines and then maintaining them in safe operating condition).

The detail work of the various functions of Tool Engineering is at present being performed and directed almost exclusively by technicians with a high degree of specialized skill which has been attained during practical experience in the shop, and particularly in the tool room. In consequence the work is based largely upon tradition and past experience, and it is essentially of an empirical nature rather than analytical. This practice is usually ultra-conservative and fails to take full advantage of the latest developments that have taken place in sciences and engineering.

The employment of technicians for many of the functions of Tool Engineering is commended, but we educators hope that more industrial organizations will provide systematic training programs for these men. A breakdown of the seven functions listed in the definition of Tool Engineering I have used indicates that there is a very reasonable division of the general field into two main groups. The excellently trained technician is eminently and best fitted to serve the first of these groups—jig and fixture design, design of special cutting tools, dies and molds, installation of machines and plant equipment, and maintenance of all machines and tools in the plant. The technologically trained mechanical engineer who has entered Tool Engineering in the plant is best fitted to serve this second group —design of special machines and other equipment for the manufacturing department, supervision of construction of such machinery and equipment, selection (for purchase) of machines and standard tools for the plant. We engineering educators hope that more industrial organizations will see the advantages of such grouping and the relative qualifications of each of these types of men, the skilled technician and the trained technologist.

Post-Collegiate Training Essential

Just as an industrial training program is necessary for the development of

the skilled technician, so also is a separate and different post-collegiate training program in industry necessary to take the raw product of a mechanical engineering curriculum and develop a trained technologist. No engineering school today thinks for one moment that its product at the end of four years is ready to step into a job without additional training. Engineering education has attempted in the last twenty years to definitely limit itself to that kind of training which can best be given from books in school and to leave to industry for possible collegiate training that part of a trained technologician's training which can best be given on the job. Proper organization and effective leadership of the Tool Engineering divisions will then utilize the skilled technician on those phases of the industrial Tool Engineering problem for which he is most suitable and the trained engineer for those other, more involved phases, for which he is the most suitable.

Separate programs for the different specialized functions may be presented jointly in the plant, evening high schools, and vocational schools. For the supervisory positions we believe the graduates of our courses in mechanical engineering are well qualified after they have had a period of orientation and practical experience in the shop. One of the most difficult problems that confronts the engineering school and the young engineer is the problem of getting that kind of experience. The unions take a very difficult position with respect to the young engineer coming out of the school who needs to get down and work on the job.

Industry frequently says, "Why should I hire a college man and then put him in the shop?" We think they are taking a shortsighted point of view. We believe that the college man needs to get into the shop, both in his vacation periods during the college course and immediately upon graduation, and get down to brass tacks and learn those aspects of his education which we cannot possibly give him in college. This post-college program should be laid out with special reference to Tool Engineering, and may be supplemented by courses in colleges and universities if they are conveniently located, and by assigned reading of technical literature.

Fallacy of Training for First Job

It is frequently said that the boy on graduation doesn't know anything about his first job. Remember that the young man while he is going through high school and while he is going through college doesn't know what job he is going to get on graduation. If we try, I believe fallaciously, to train him directly for that first job and then he didn't get a job in that particular field for which we had trained him, where would he be? Our problem, then, in taking these numbers of men, is to make their training so broad, so fundamental, so basic, that it applies with equal weight to a great number of fields, and that is the answer that almost every engineering educator in the United States would make to you if you came to him and said, "I want a boy who is trained so and so, so and so, and so and so," and you would know better than anybody else how you wanted him trained.

The educator would say to you, "Now, wait a minute. How do I know that if I took ten boys a year and put them through precisely this program you stated you would hire them on graduation?" Even in these cooperative programs where the men work alternately in the university or in the engineering school and in industry, the men on graduation from that aren't all hired by that one company. They shouldn't be. There is a selective process that has to go on, and you gentlemen are the ones who do the selection at the end. You are the ones for whom they are going to work finally. We can't tell you whom you should hire. We shouldn't. If we limit it down too narrowly then we have done an irreparable damage to the boy whom you don't hire.

Although the practically trained technician may be more suitable in some respects for the performance of the detail work, the college trained engineer is far better qualified to correlate the various phases of Tool Engineering and to interpret past performance of machines and tools and the results of scientific investigations and to apply them to the tools of the plant. In addition to his studies in the fundamental sciences, physics and chemistry, with mathematics, economics, English and other subjects, and a variety of engineering subjects, the mechanical engineering student receives instruction in the following subjects which relate directly but fundamentally to the work of the Tool Engineer:

Machine design and applied mechanics.

Selection of engineering materials.

Metallurgy and heat treatment.

Shop processes, which includes consideration of the physics of metal cutting and metal forming, as well as a study of the common metal working processes and the equipment used for them. Essential considerations in the design of jigs and fixtures.

Economics of machine selection.

Process machinery. Analysis of production machinery other than metal working.

Shop organization and management.

Research—Vital to Tool Engineering

The university educator also considers research a vital factor to progress in Tool Engineering and the engineering graduate is trained to conduct this. Research and investigation may be conducted in many lines pertinent to Tool Engineering, such as metallurgy, heat treatment, chip formation, effect of tool shape, cutting lubricants, motion economy studies relating to machines and equipment, analysis of the forces and motions in mechanisms of machines, and many others.

I spent about six months in Germany in 1931 studying their engineering educational systems, and in every engineering school in Germany that summer there were long and detailed research processes going on in metal working. But could I pry any information out of those professors as to what they were doing or what results were being obtained, or have I seen any publication of the results of that research? No, that is locked up in the metal working industries in Germany today.

You don't find any of that research going on in this country. There are millions of dollars being spent for research, but not research in the field of Tool Engineering.

The engineering school graduate represents a highly selected and fundamentally trained person. Only a fraction of the high school graduates can secure admission to and complete a course in engineering. And in that connection, Mr. Stilwell, there is an enormous amount of vocational guidance going on in our engineering schools today. It is going on in our high schools, too. I am called upon, for instance, probably three times a month in the metropolitan region in New York to go out and speak in high schools on vocational guidance programs. The boy there wants to know what kind of a capacity he has to have in order to get into an engineering school, which is the first step he is going to go through to be a trained engineer.

And they have developed a very excellent system here in this metropolitan region. A joint committee of all of the professional engineering societies has been organized and when one of these vocational guidance programs is put on in a high school in New York some one speaker will go out and address the whole group, as I am addressing you, for instance, or as I have done in these various schools. Going along with him there will be a mechanical engineer, an electrical engineer, a civil engineer, an aeronautical engineer, communications engineer, and so on. The students are then broken up into smaller groups—depending upon their interests—in any of those particular areas of engineering, and on top of it, that committee has a list of 700 engineers in the metropolitan region who are tops in their profession, who have indicated their willingness when the committee calls them to give fifteen minutes, once a week, to a high school boy in the metropolitan region for an individual conference. And believe me, then is when you get down to

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HIGH SCHOOL VIEWPOINT of Tool Engineering Education

By E. L. BOWSHER
SUPERINTENDENT OF SCHOOLS
TOLEDO, OHIO

IN order to best understand the high school viewpoint of Tool Engineering Education — in fact, the high school viewpoint of any type of education, we must first understand something about the high school — in fact, our whole school system, its historical background, its objectives, its plans of procedure, and its place in our local, state and national setup.

Education Foundation of Democracy

Mass education is the foundation stone of American democracy. Our Pilgrim forefathers believed in it. Early in the seventeenth century they had established schools and a university. They made real sacrifices that their children might be given educational opportunities. The success of the experiment in democracy on American soil is dependent in no small measure on the education of all classes of our citizens. When the time comes in any country that the intelligent understanding of the masses is so far below that of their leaders that they are unable to interpret the acts of these leaders, that nation is ripe for dictatorship, and whatever of democracy it may have had is doomed to destruction.

Education begins the day he is born and carries on through the entire life of the individual. The responsibility for its success rests on the home, the school, the church, the community, and the State. If any one of these institutions fails to contribute its part, the problem becomes increasingly difficult for all the others. In past years, and even now in many places, little has been done for children of pre-school age and those of the adult level. During the past decade, however, rapid strides have taken place in both directions.

While the American people have generally favored mass education, our present marvelous educational organization has not been developed without combat. Conflicting ideas have been ever present. Individuals and groups always opposed the idea of free education to all classes of people. Common schools in the United States developed very slowly during the first two centuries of our history. In fact, the schools of a century ago were very crude from every standpoint when compared with those of today. Little did the celebrated Horace Mann, often known as the father of the American public school system, realize that a hundred years after his time we would have the comprehensive system of schools in America that we have in 1940.

Today there are approximately 276,500 public and private schools and colleges in the United States. Normally a new school house is completed every day in the year. From 1934 to 1936 the number of elementary schools decreased by 4,000. (I want to say to you by way of injecting something that isn't in the paper, one of the big problems we have in public education today is the rapidly decreasing number of children that are enrolled in our elementary schools.)

During the same period there was an increase of 900 public high schools. The number of public high schools increased from 16,300 in 1918 to 25,600 in 1936. The high school has been largely developed since 1880. Since that date high school enrollments have increased 3,900 percent. More pupils are enrolled in the American high schools than in the high schools of all the other nations of the world combined. About 31 million persons are enrolled in our fulltime day schools. Many thousands are also enrolled in night, summer, correspondence, and private, trade and vocational classes. Elementary schools enroll approximately 23 millions; high schools 7 millions; and higher education institutions, one million. About 90 percent of all fulltime pupils are enrolled in publicly-controlled schools. Every state in the nation has compulsory school attendance laws. About 95% of all children of elementary school age are actually enrolled in school. Only 67 percent of those at the secondary school age may be found in high school, and only 12 percent of our college age persons are registered in college or university. More than a million high school and 143,000 college and university students graduate each year throughout the nation. Over a million teachers are found in all types of public and private schools of all levels. Of this number one-fourth are men. Last year there were about 500,000 members of boards of education in the country—one board member for every two teachers. This tremendous business of education last year cost the people of this nation $2,631,000,000. The cost of land, buildings, and equipment owned by educational institutions is estimated at $10,116,000,000.

In spite of this vast program of education in the United States which has practically eliminated illiteracy, probably 25 percent of our people are still grossly ignorant. The medium educational accomplishment of the country as a whole is but the completion of the eighth grade. Only 3.32 percent of the nation's adults are college graduates; 15.1 percent of the adults, including the college graduates, are high school graduates.

Education Falls Short of Ideal

In helping our democracy to move forward, we have at hand this marvelous educational organization developed at great cost. It has been created for that purpose. In the midst of all our social confusion we must come to realize that our system of education has fallen short in many respects. We have not kept pace with a rapidly changing social order. The solution of yesterday's problems will not work today because the problems are different. The picture of tomorrow will undoubtedly be different from that of yesterday and today. Civilized peoples are on the move. Democratic government in most countries is on the rocks. Strange philosophies of government are in the saddle among the older nations and are knocking at our very doors. Millions of men in Europe are under arms and struggling at each other's throats. The adult citizen of this country is bombarded from all sides by new and conflicting ideas concerning all our fundamental social institutions. He must become equipped to find a rational way out. Economic necessity, ignorance, and shiftlessness have forced countless thousands of our people below the poverty line. Probably 10 millions are on the lists of the unemployed. Many of them will never be employed again. Five millions of our young people between the ages of 16 and 34 are out of work. Many of them are high school, college and university graduates. Little children are living in homes the condition of which makes it impossible for them to ever obtain a fair start in life. Lack of food, clothing, and medical attention have rendered many of the pupils of our schools physically unable to do their best work. About 85 percent have physical defects which interfere with their educational progress. Many states have such a low compulsory school age limit that children are out of school, employed in sweat shop labor at home or in industry, before they even get a decent start in education. Others of school age have become floaters and have taken to crime as a way out. Most of these young criminals have never gone beyond the fourth grade in school.

It is right in the middle of this unfortunate and shifting social situation that we school people find ourselves. It is an issue that we can no longer sidestep. We must assume our fair share of responsibility for the weaknesses of

(Continued on page 28)

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our social and economic structures. The whole pattern of the American schools was inherited from European background. Until recent years it had been the attitude of education not to question any phase of the social order but rather to perpetuate it as it had existed. We still have too many people who don't know where they are going. On the other hand, we do have another type of educator who sets up objectives, specific objectives. You get it in your business the same as I do in mine, you have the same type, who sets up objectives, and nobody would be more surprised in the world if those objectives were achieved than the individuals who set them up. You have seen that kind, have you?

It now becomes our duty to assume a part in the building of a new social order. The curriculum of the schools has its roots deeply imbedded in the past. It is now in the process of fundamental changes. Its value as an effective agency in a changing democratic society will most certainly be reflected in the type of citizen that it produces. The ideal curriculum of the ideal school is an ever-changing, dynamic, living thing. This is true because the school serves the ever-changing, dynamic, living needs of human beings who are preparing to enter the shifting fields of work, of home, and of citizenship. The curriculum of yesterday made provisions for the needs of the select few of more than average ability and academic inclinations. The secondary schools of a quarter century ago enrolled but this select few. The others left school at the end of the eighth grade and went to work. In those days there were two jobs available for every boy. Today there are four boys for every job. The high school curriculum of today and tomorrow must recognize all the children of all the people.

The child of average and below average ability is now enrolled. He is there because he has a right to be there. He is not academically inclined. Probably 80 percent of our high school students belong to this group. They never expect to go to college nor should they do so. I might say right now that there are too many people enrolled in college who shouldn't be there, and it takes a year or two or three, and a thousand or two thousand or three thousand or four thousand dollars of their parents' money to find out they shouldn't be there, unfortunately. They will graduate from high school and be immediately placed in the position of making a living for themselves. For this group their formal education ends with high school graduation.

In the ordinary academic high school two evils result with these pupils. Since they are not academically inclined they develop a dislike for school, drop out, or are graduated on the basis of time served rather than results accomplished with little credit to themselves or their school. If any of them attempt to go to college they usually fail to do successful work because of inadequate preparation. They become a problem on the labor market because they have received little or nothing in their educational experience of value to them in making a living or living a life. By their teachers they are dubbed dull norms and by society, failures. They are not dull and they never should have been permitted to become failures. The school has simply "muffed the ball" in failing to meet their individual needs.

About 92 percent of all the people in this country gainfully employed in industry work with their hands. The schools have largely ignored this fact and have concentrated 90 percent of their efforts in training pupils to fill the white collar jobs. By the very nature of things not more than 8 percent of all our graduates could ever enter the so-called learned professions. Since these large numbers of our people do work with their hands, the schools schould accept the definite responsibility in training them to go out into the world of industry better equipped to so work.

Vocational education is greatly needed. This need has been recognized. The states and Federal government have done much. Under the Smith-Hughes and George-Deen Laws the United States government is distributing millions of dollars annually to the various states to assist in vocational education. Hundreds of high schools are already providing these vocational courses, and the number is rapidly increasing. Through vocational training in the basic trades of the key industries many of our high school boys and girls go out into life better prepared to make their way as happy and prosperous citizens.

The School Concept

The general concept of the purpose of the school is to develop the intellect, build citizenship, character, and to provide a means whereby the individual may develop a cultural, academic, vocational and practical background upon which he may rely for his future security. The ultimate goal, and perhaps the most perplexing problem of every individual is that of finding a source of economic security, standard of citizenship and livelihood on the strength of his or her background of education, little or much, formal or practical as it may have been or may be.

As industrial and economic conditions become more and more complex and acute, people engaged in the job of educating must inquire more and more into the needs for the methods of improving the education process. The general public, industrial, business, and civic organizations are today, as never before, raising questions about the product of education. In fact they have become so much concerned and disturbed with the problems of education and youth that nation-wide and local surveys and studies are being made.

Survey on Education

The recent study made by the American Council on Education admits certain conclusions significant to secondary education and youth problems, viz.,

"1. The necessity for equalization of educational opportunities (the adjustment of the school program to more adequately meet individual needs).

2. The need for assisting youth into employment upon leaving school either by graduation or the necessity of having to leave school before graduation for economic reasons.

3. The need for economic security on the part of youth.

4. Adequate vocational guidance during the secondary school period.

5. The need for accurate vocational training based upon the local need as determined by a continuous process of occupational analyses.

6. The need for the reconstruction of a good general secondary program of education i.e., an educational program more in keeping with local, present day, vocational, cultural, civic, social, and recreational needs.

7. Need for adequate recreational facilities, (school and community)."

These seven enumerated problems may be summarized into three major problems facing American youth—education, employment, and recreation.

From the standpoint of education, the learner is interested in that type which is most likely to conform to his interests, needs and functional abilities as they relate to a more adequate preparation for employment.

Following this preparation employment becomes the major factor in his economic security. He wishes to determine where and in what capacity he might function to best advantage in making a living and living a life.

Due to changes in the social demands upon the American people, the reduction in the number of working hours per day, the increase in the amount of leisure time alloted to individuals and groups, we have the problem of developing a program of recreational activities to absorb energies that otherwise would lead to disorderly and delinquent behavior.

Recent studies reveal some alarming facts. A recent report of the National Youth Commission under the leadership of Homer P. Rainey submits the following facts:

"1. Studies made show that there is almost no relationship between the types of training which youth receive and the jobs which they enter.

2. Approximately 70 percent of out-of-school youth are not trained for any skilled jobs. And as high as 40 percent are not trained for any kind of job.

3. About 75 per cent of all youth are out of school at the age of 18 years and

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are unemployable. Coupled with this is the further significant fact that there is a growing tendency to exclude youth under 21 years of age from employment, thus widening the gap between the school and the job."

I think one of the big problems of education today, and you gentlemen are going to have to play your part in helping solve this problem, is to develop something of a further educational program for the youths between the ages of 18 and 21 who can't be absorbed in industry and who, according to our present plan of education, if they are unable to go to college or the university, are out in society, God knows where.

Thus you have a few high spots in the picture of education and some of its problems, involving not only students who may enter the field of Tool Engineering but those who may go into many other industrial fields of endeavor as well. You as employers of Tool Engineers and, in large part, as expert engineers yourselves, expect us in education to do the very best job possible in providing you with young men properly equipped to enter your field. We as school people, feel we have a long way yet to go to do the job properly.

The Tool Engineer is usually a highly technical man, a designer in most shops, generally a university graduate from the college of engineering. Some of your highly skilled men have never graduated from college or university but have worked their way up through the ranks. Besides these expertly trained leaders in your profession you have many thousands of others engaged in the tool making industry who have had little college or even high school training. They are men for whom the schools have done little in training in the basic skills so necessary to success in your industry.

High School Responsibility Two-Fold

The high school therefore has a two-fold responsibility. First it must set up a program of educational activities to adequately provide a sound preliminary background of training for those young men of unusual ability who will later enter the college of engineering and thus become the most highly skilled members of your profession. How can the school best render effective service for this group of young men? For that type of training there is no short cut. A comparatively small percentage of the student body of any general high school will have the natural ability or inclinations to follow the courses essential to such preparation. Through a proper system of vocational guidance making use of general intelligence and special aptitude tests and personal interviews students should be carefully selected to follow pre-engineering training. The technical high school is the best answer. In such a school courses heavily weighted in the fields of physics, chemistry, mathematics, shop work, and drafting are most essential.

This school should be a purely college preparatory school. The students enrolled should be most carefully selected. No pupil of average or below average ability should be admitted. The teachers should be most carefully chosen. The standards of teacher training should be high. No teacher with training less than the amount required for a master's degree in his subject matter field should be appointed. A continuous and careful survey of the results attained should be a part of the program of such a high school. Students graduating will thus be well prepared to enter college or university in a number of fields highly technical in character.

Unfortunately we have not done much as yet in the establishment of the highly technical high school. This is due to two factors, one the fact that in about three-fourths of the high schools over the whole country the enrollments will not exceed 200 students per school. In the smaller cities and rural districts there are not enough high school students available to establish this highly specialized type of school. Either certain specialized courses must be set up in these smaller schools to meet this need, or means should be provided to assign certain well selected students to the technical high schools located near by in larger centers of population.

The second factor prohibiting the establishment of the technical high school, even in our larger cities, where adequate numbers of students are easily available, is the item of cost. The cost of highly trained teachers, modern machine tools, first class equipment for science laboratories, and drafting courses and modern buildings are far in excess of the costs for instruction items in the traditional high school. In all communities the public must pay the bill for education. Thus, in order to secure the necessary funds to develop this highly specialized type of secondary training, we people in the field of education solicit the public support and wholehearted cooperation of men constituting groups such as yours. You can also do much to help us do properly the job that must be done by making an honest effort to assist the school administration of your various communities through making a study of the high school curriculum and helping them set up the proper educational objectives to best meet the needs of your particular profession.

The second function of the high school is to develop a program to meet the needs of the large number of boys who will never qualify as technical experts in your field, who will never go to college or university, but who nevertheless will become an integral part of the tool making industry. Many of them will become tool makers, machinists, and die makers. Others will fill jobs requiring much less skill. Yet they also are essential to the success of your business.

I am convinced that the vocational high school and the general high school with specialized vocational departments will accomplish much in the development of the basic skills, and related knowledge to help boys and girls find their places in the field of industry. These courses should be set up in such a manner that they will offer opportunities to students on different ability levels. These students will become workers, indispensable to industry. There is apparently never an adequate supply of first class skilled mechanics. Our Vocational high schools organized under the Smith-Hughes and George-Deen laws can supply you with carefully selected, well prepared, advanced apprentices. We do not plan to graduate from these vocational high schools finished tool makers—only advanced apprentices with foundation manipulative skills. This vocational training also provides related knowledge in the fields of mathematics, science, drawing, trade information, and social intelligence that will result in success as skilled worker citizens. I want to say, here, we have done a good deal in our city toward the development of a vocational program and one of the most difficult problems I have is to find and select the type of teacher in the vocational high school who is an all-around individual, who has a reasonable amount of education, and at the same time knows his particular job in the skilled industry.

It was my experience just a few weeks ago to select a man to head up a department of auto collision service. I had a whole flock of applicants, some fifteen or twenty, men who had had a lot of successful experience in the field of auto collision, and out of the whole bunch I only found one man who could really talk United States.

Again in this we need your help and cooperation. Vocational high schools cost more money than the traditional schools. They must be equipped with first class and up-to-date machinery. They must also be staffed by expert teachers, men and women who are not only well trained teachers but expert tradesmen as well. You can do much in your various communities in the development of a public attitude favorable to the establishment and maintenance of vocational schools. In order to carry on a real vocational program it also becomes necessary to work out a plan of cooperative assignment of advanced students for regular periods to your various shops and offices. Thus your industries become the laboratories under real working conditions for our

(Continued on page 68)

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VOCATIONAL VIEWPOINT of Tool Engineering Education

By THOMAS P. ORCHARD
INSTRUCTOR, TECHNICAL EVENING CLASSES
PATERSON, NEW JERSEY

I FEEL particularly honored at having been requested to express my views on Tool Engineering Education along with well known educators, for the reason that I certainly am not an educator and any complimentary opinions to that effect are purely local.

While I have been an instructor in Vocational Schools in two Eastern states, I profess to be a practical Tool Engineer and have never seriously considered following educational work as a profession. Therefore, my present interest in this subject came about by my observations of the experiences and predicaments of ambitious young men endeavoring to learn something about Tool Engineering, but not knowing how to go about it, or where to get at least a start in educating themselves in this field. Their experiences somewhat paralleled my own of a good many years ago and as my experience in this profession started in the shop and took me through drafting, tool designing, production planning, etc., naturally my thoughts have run along that particular branch of the many that go to make up Tool Engineering.

My viewpoint on this subject is supposed to be that of the Vocational School. I would like to start by asking the question—"What is a Tool Engineer?" Our Chairman has stated that Tool Engineering includes plant managers, plant superintendents, shop foremen, shop supervisors, production supervisors, tool supervisors, methods engineers, tool designers, tool makers and sales engineers. You will no doubt agree that no institution of learning at present can deliver to industry, plant managers, plant superintendents, production supervisors, etc., ready and qualified to start work at such a job. It therefore appears that these positions which go to make up Tool Engineering seem to represent a progression of steps upward from one job to the other, starting from the bottom, which in my opinion is practical shop experience.

College Training not Practical Enough

Colleges deliver young men fully equipped and ready to go to work for the legal, medical and other professions. Then why should industry be expected to conduct its own schools, and over a period of years, educate graduate engineers in order to make them definitely useful in some particular branch of Tool Engineering. In other words, industry bears a heavy tax burden, a part of which goes to education and in addition it is expected to educate its own future executives and key men after it has helped to educate them in universities and colleges. It seems to me, from a practical standpoint, that the burden of getting young men started on some definite beginning stage of Tool Engineering lies with the Vocational Schools, but I further believe that as Vocational Schools are growing larger and more numerous, they are rapidly, though probably unconsciously drifting away from the practical views on which they were originally established. In other words, the Vocational Schools are trying to go "High Hat," so to speak. Their requirements for instructors are constantly being raised to a point where in many instances one must be a college graduate to qualify. Where will you find a college graduate who will put on overalls and go into the shop for a long enough period of years, to get the practical experience he should have to be a competent Vocational School instructor, and who will then give up his shop salary and his chances for advancement, to start at the bottom as a Vocational School instructor? As a result of this, Vocational Schools are being manned by instructors who have a good theoretical education, but no practical experience. This means that the laying out of the courses and the instruction given are far from being practical from industry's point of view.

Practical Instructors Necessary

Every young man studying Tool Engineering will not become a Plant Superintendent, but he can become a part of this great profession in one of its many necessary jobs. The great majority of young men interested in getting a Tool Engineering education are those who could not attend college, but who are looking for the practical education that will give them a definite job and a toe hold, so that they can try to go up the hard way, and a large percentage of key men and executives in industry today have reached their present position by that method. This does not indicate in any way that I do not favor higher education. On the contrary, I think it is a wonderful thing and any young man who has the opportunity to take advantage of it is indeed fortunate. I do believe, however, that before a student wishing to study the higher branches of Tool Engineering in college can qualify to do so, he should be required to study shop work and tool designing in a Vocational or High School and he should get credit for this work toward a degree at college. Of course, the objection to this could be that colleges might object to this work being accredited if the instructors in the Vocational Schools were practical men rather than theoretical graduates. This is the one big problem that must be solved and until this point can be adjusted, at least the student would receive enough practical education in these two subjects so that he could get a job in which he would be immediately and definitely useful to industry. Leaving generalities and getting down to more specific points, I would like to give my idea as to what a practical course really should be and wherein I think it differs from the general practice in Vocational Schools and these views are submitted in the hope that any future committee working on this subject may find something worthwhile in the suggestion. As previously stated, most of my work has been on tool designing and production planning and I believe I can best illustrate my ideas of a practical course by giving my own experience along this line. Of course, this only covers tool designing, which is one of a number of branches in Tool Engineering, but it is one of great importance and other branches could be worked out in the same manner. Some time ago a half dozen ambitious young men asked me to give them private instruction in Tool Designing, the result being that without any intention on my part, I now have on my hands what is locally referred to as a very successful and practical evening school. This school started accidentally with these six students and the attendance now runs between seventy-five and one hundred. The school has no endowments and is supposed to be self-supporting.

A Solution

Students attending learn to be Tool Designers and many of them work in shops, some are still attending High School and others are men out of college. The entrance requirements are a sincere desire on the part of the applicant to become a Tool Designer. This is a far cry from the usual standard set up by schools and colleges. However, an ambitious young man earnestly seeking an education and a chance to better his condition should not be denied the opportunity, therefore, these are my requirements. The success of this school, which means the methods used in teaching as well as what the students are taught, was accomplished by giving serious consideration to a great many things. All of these students

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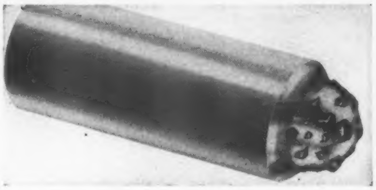

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40% of All Carboloy Jobs At DeWalt Are Steel Cutting

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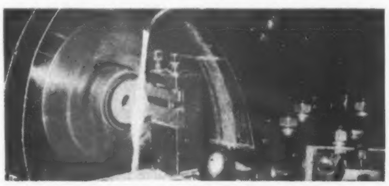

per minute, .065″ feed, ⅛″ cut, the Carboloy tool used stands up for the lot of 250 pieces and is still in good condition. 40% of all Carboloy operations at DeWalt are on steel. Through the carefully planned, general-purpose use of Carboloy, DeWalt have successfully applied this cutting material to 80% of all machining operations in their plant.

DISCUSSION of Tool Engineering Education

By DON FLATER
WORKS MANAGER, CHRYSLER CORPORATION, CHRYSLER DIVISION, DETROIT, MICH.

According to my assignment I am to discuss the papers as submitted by Messrs. Stilwell, Barker, Bowsher, and Orchard. It would not be advisable to cover this assignment on every detail and statement but will comment on what I feel are important items. The problem, which we all wish to solve, is not that of details but of a general and broader subject as we see it from a Management viewpoint.

I am highly appreciative of the problem that educators have in trying to develop students who will be of value to industry and realize thoroughly the responsibility that industry has in cooperating with educators in arriving at a series of work and study that would be advantageous to business. A complete solution is still ahead of us.

Industry has no complaint to offer on the technical ability of the graduate engineer as he is usually familiar with the necessary engineering requisites, such as mathematics, drafting, design, machine and tool line-up, etc. As a rule, in a manufacturing plant, sources are available on chemistry, metallurgy, heat treat, etc., or other technics that he may be required to know to satisfactorily perform his work.

Room at the Top

One of our problems in the industrial field today is that of securing competent supervision, engineers, and personnel for all responsible positions. This is not due entirely to lack of persons available who possess or could possess the qualities required to fill these positions but is due to lack of outstanding accomplishments on the part of these persons to gain recognition which might demonstrate that they are capable of greater responsibilities. These accomplishments, however, should be of such a nature as to receive recognition on their own merit. Industry is realizing more and more the importance of having a number of men in the organization with an engineering education or degree, as this education is certainly most advantageous provided the individual has had sufficient practical experience and possesses the other requirements that will make him valuable to an organization.

More business failures, according to statistics, throughout the United States are attributed to lack of technical and executive experience than any other one cause. It is not absolutely essential that an education be procured in a college although that is usually the best way to obtain it. There are individuals where this way is not the most satisfactory as the college man does not always absorb beneficial qualifications that the engineer does who comes up the "hard way." He very often comes to us as a graduate with a warped attitude, highly over-estimating his value to Management.

Due to the great progress which is being made by industry along scientific lines we must not overlook, forget, or under-estimate the importance of the university laboratories as a source of men who will be trained along these lines, as colleges have been very cooperative in working out experiments with industry. Their laboratories will always be producers of scientific discoveries.

Industry desires greater things than just a good engineer. I have previously acknowledged the fact that students are turned out with sufficient technical experience, however, as the time permits and they are sufficiently ambitious to absorb more phases of manufacturing than you are now teaching it naturally will be an advantage.

The big problem is not entirely that of scientific and technical education but of characteristics of the individual in which we have a great problem and which requires much of our time to eliminate.

We can have close supervision and eliminate mistakes that may be made, but when the Tool Engineer is in Management and industry he must depend more on his judgment than he did in college, as we must have engineers that we can depend upon.

Do not let the student confuse experience with a college education but let us train the men in college how to get experience through aggressiveness. We often determine the size of a job by the ability of the man who holds it. Jobs are sometimes elastic and will grow if the man grows and cease to expand when he stands still. The alert Tool Engineer will add to his job something that was not there before. He will achieve the maximum when his mental processes are dominated by intelligent inquiry and analysis. From the attitude of his mind comes the results that bring the company its profits. Educators should know something of his state of mind and correct if possible. Occasionally habits of mind, developed in school, stay with the individual forever and are hard to change.

Management Defined

As a matter of clarification, I believe we should analyze what Management is, in view of the fact that educators are desirous of obtaining recommendation from Management to improve their courses. Management is the unseen force which directs that which is physical within a factory and is by far the most important factor of the present industrial age. Machines may be put to work, workers may labor, sales departments may sell, but without adequate management to organize and consolidate them into a profitable organization to distribute the results of their work effectively, to govern their operations during performance, the industry may become so uneconomic as to cease entirely. We are prone to see the physical side of industry and are likely not to think of the directing force, but to see only the results. Management unites all the elements in the control of business activities and correlates all the details of operation so the organization will work as a whole toward the desired goal. That goal is profit, and supervision and engineers must be responsible in their operation for creating and maintaining policies that will contribute toward it. The engineer, particularly, must do this to gain the proper recognition of his ability.

Engineer Defined

When we refer to an engineer, we have in mind an individual, whether he be a college graduate or not, who has a technical education and possesses the power of analysis, which is the most necessary possession of an engineer. He should be fortunate enough to possess a studious mind, as mind is the power that conceives, judges, reflects, imagines, and remembers. These engineers should be men of creative ability to establish policies and the ability to execute methods and plans that are devised for them.

I, personally, regard Tool Engineers as one of the very best sources of personnel to assist in taking over the reins of industrial management. Therefore, we are most interested in the education as a whole that will teach them to assume responsibility, to learn, to observe, and absorb the requirements of manufacturing that will make them eligible for that responsibility.

Industry can purchase experience and ability but the individual must be of such a mental temperament that he will apply his experience and ability in such a manner as to properly function in the plant where he works. It

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has been said that education without the will to work is intellectual mockery.

Further qualifications of an engineer that are basic should be that he has a natural bent of curiosity, is intelligent, and should enjoy his work. It is important that he has had enough personal contact with individuals to educate himself in the personalities of people. He should possess the same characteristics as any other individual. They must be taught that mechanical progress has been accomplished through the required needs of mankind, imagination, curiosity, and the desire for achievement. They should be taught that knowing one thing thoroughly and in detail is necessary and advantageous, but fundamental knowledge of other related activities and functions will, in practically all cases, prove advantageous.

There is a popular magazine which has a column each month with the caption "Why Don't They?" It appears that the application of this caption to one's mind should produce a great deal of new developments and improved methods. The basis for all these can be laid in school.

I know of no industry quicker to recognize genuine ability than that of the automotive industry. Men on the outside often ask me about jobs and the industry. They ask, what are the opportunities, what is the best training for it, and how much money can you make. I always tell each and every one the same thing, and that is, that the sky is the limit in the industry providing they have the requirements; and by requirements I do not mean only highly specialized training. What I do mean is the native intelligence, initiative, good common sense, the power of observation, and ambition plus the willingness to work like the devil and assume unlimited responsibilities. To get themselves trusted and liked is the hardest step, a responsibility of which industry and the educators must share alike. After that it is a matter of learning the business and to be prepared for the opportunity when it presents itself.

We try to teach the men that to reduce the monotony of any job is to think of ways to improve the task before them.

I note that a statement was made that the positions which go to make up Tool Engineering seem to report a progression of steps upward from one job to the other, starting from the bottom, which is practical shop experience. This is a very true statement and when shop experience is mentioned we assume that the interpretation is a good mechanic. A good mechanic has a working knowledge of tools, machines, and equipment. I believe Webster's interpretation of a mechanic comes as near meeting our requirement as any. Webster says he is "an intelligent workman." To be a good craftsman, and certainly a good Tool Engineer should be a good craftsman, therefore he must broaden his intelligence.

School and Factory Cooperation

A statement was made in one of the papers that vocational schools are being manned by instructors who have a good theoretical education but no practical experience. We appreciate that in college actual operating conditions do not always exist and therefore a student can only obtain the theoretical side of Tool Engineering. It is suggested that perhaps classes could be formed among Tool Engineers in college and these classes be sent into various manufacturing plants to determine their problems and after the problems were thoroughly understood, to work out various solutions, checking them back with the Management of that particular factory presenting the problem to determine whether the solutions, as formed by the students, could be used to an advantage. I believe any company would be willing to cooperate with our vocational schools on a plan of this kind.

Every effort in college should be made to give all the credit possible to a student who obtains practical shop experience. Most individuals are anxious to complete their college courses and get out of school. Credit for practical experience will create, in time, the desire to get better credits and work harder.

If I were a vocational instructor I would make it a point to insist that students visit all the nearby manufacturing plants with the idea in mind of putting a portion of my leisure time in them, following units through their fabrication stages so that I would be on definite speaking terms with them. I would read all periodicals, magazines, and papers that applied to my work, join organizations, such as the A.S.T.E., and would make it a point to mingle with these individuals with practical experience who are in on the "know." This reading of magazines, trade journals, and conversation with people who are experienced in the subject you are interested in, will be most beneficial. Lectures on technical subjects should be attended. This applies to the student, the instructor, and members of Management. Experience is not usually obtained at a desk but at the point of activity; although many fundamentals may be obtained from reading. It may be said by the instructor or the student that he does not have sufficient time to do these advantageous things. In most cases the problem of finding time is only a matter of the will to do so and arrangement of just how to allot the time. One hour per day properly spent will practically make an individual familiar with the fundamentals of almost any science, or other subject, over a year's period, which is probably comparable with the time spent on an average college subject.

Keeping Up-to-date

Sometime ago I was discussing with a factory executive the advantages that the individual had who did a lot of studying and reading and the attending of technical sessions, over the one who failed to do so. In the discussion the late developments in plastics were brought up. This executive stated that he knew something of the new plastics and was curious to find out how many executive engineers and supervisors in his organization had given any thought to the matter, or who had made any effort to gather information concerning it. He contacted twenty-five of these individuals and found that there were two among the group who knew anything at all covering the subject. The remaining, who were people in responsible positions in a body plant factory where plastics are used, could not name one item other than their own that they used that was fabricated from plastics. Perhaps this subject was unrelated to their work somewhat but the swelling of the "bump of curiosity" evidently had been reduced through the lack of ambition and interest. Therefore, do not let the student conceive the idea that books, magazines, etc., only consist of elementary knowledge. Research study in a library must not be accepted as a method of avoiding original thinking. Perhaps you cannot make the student study and work but you can induce him to want to do so by creating an ambitious desire for personal achievement. The above statement, in my estimation, is of most importance.

Educators have a responsibility in teaching students not to over-estimate their earning power because of a college education. A college graduate is in the same position as an athlete would be who had rigid training, put himself in fine physical condition, without any boxing training or experience, and was pitted in the ring with Joe Louis.

Another statement made was that the entrance requirements to the vocational school are a sincere desire on the part of the applicant to become a Tool Designer. Let us coach this applicant to strive for even greater things than a Tool Designer. His opportunity for advancement is too great to stop there.

Is your student in college for self-development and improvement, or is he there because Dad sent him. This is a psychological problem for the instructor to determine and correct.

Well-Rounded College Background

An effort should be made by colleges to create in the student a desire to learn about everything pertaining to the work which he eventually intends

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to follow. This can be brought about through pointing out the personal advantages that the individual will eventually obtain from this knowledge. I have found it resultful to discuss a man's hobbies with him in order to inspire him. In discussing hobbies with some of our executives and engineers, where perhaps he was interested in fishing, hunting, photography, or skiing, they will often make the statement that they are very desirous of obtaining additional equipment to make their hobby a greater pleasure. I have tried to tactfully point out that greater creative work on their part and willingness to assume greater responsibilities possibly would result in higher earnings, permitting them to purchase more equipment to fulfil that gnawing created by a hobby. The same ardent efforts put forth on hobbies will make the engineer outstanding in the eyes of Management if this same effort is applied to his job.

After analyzing the student and being satisfied in your own mind that he possesses the qualifications and capabilities for a Tool Engineer, make it a special point to advise him on his elective subjects so that he does not waste a lot of time on something that will never be of any advantage to him.

Have you ever talked with a student about his personality, his appearance, his initiative, his ambition, his observation power, and his ability and willingness to cooperate? Industry does this very thing and it is resultful. We will not dwell upon these at this time as it is up to the individual himself to develop through observation, study, and conscious application to one's self to make them become a habit. You can assist him in forming this habit.

Instructors who are engineers realize that it will always be necessary to have men with brains to operate machines, men with brains to design machines, and men who are mechanics to build machines. You can re-design a machine, you can repair it, and you can make it work, provided there are men available with brains and the willingness to do it. On the other hand, getting a man to perform a task is a different proposition. He requires a great deal more study than this as he has a mind of his own, which is perhaps as brilliant as yours. It is the responsibility of all of us to see that our working associates are instilled with the ambition to advance themselves. When a man is advanced he has done some creative work that resulted in profit to the company by which he is employed.

Students will have put in as much effort and time in college and practical experience learning to be a first class mechanic or an engineer, and perhaps even longer, than the doctor or lawyer extends in becoming the master of his profession. The doctor must serve his internship, which is comparable to the engineer's practical shop experience. I have heard good engineers make the statement that they wished they knew as much and had as much education as the doctor or attorney. If the engineer will carefully analyze, he will find that he has put forth perhaps a longer time, and certainly a lot of effort, and the tribute should be paid them that they possess just as much knowledge in their line of work as do the doctor and the lawyer. Do not let the engineer assume the idea that his profession is minor, but impress him that it is just as technical and illusive as any other profession; however, as previously mentioned, discourage any over-estimation that he may have of his value in the industrial field until he has obtained knowledge of the fundamentals of an organization and its activities, and absorbed sufficient experience to create economic developments and improvements.

Aptitude Important

Perhaps you have developed in your classes a good Tool Engineer with the right background, but he does not find the work a pleasure. I, myself, tried to learn to be a good machine and tool designer, found the work most interesting and had the ideas in my mind for designing but was never able to neatly put my ideas on paper. I was never able to print or make a neat drawing and my supervisor was always dissatisfied with my work. Hours of hard work and practice were put in trying to learn to print and do neat detail work. After a discouraging two years I found that I was not artistic enough to ever do the work neatly. I became most unhappy with the position and resolved to do something that I could do satisfactorily and asked to be transferred from tool design to Tool Engineering. If such is the case of a student, try to find out what type of work he is interested in, and if his background is such that he is capable of that work, advise him to get busy and learn all about it. Learning about anything is a matter of research and observation.

When we pick a new engineer or a man to promote to an engineering job, we pick him with the same scrutiny that the Tool Engineer selects a machine. Is he capable; is he adaptable; has he been creative; is he ambitious; is he willing to learn; will he perform the job as we require; is his personality, intelligence, and make-up such that he promotes cooperation with others? The last requirement is the one that requires the most study and analysis. Is he in the habit of doing things to which he has given no thought or preparedness? Many engineers come to us with all the distasteful idosyncrasies still not removed from their personalities. Careful study will assist in improvement in most cases. Do some "human engineering" and you will have taken a great step toward turning out more desirable graduates.

You will always have some students who plan on getting by in the industrial world on "pull." They must remember that "pull" may get them a job but may not always keep it for them. The man with whom they have the "pull" may not always be available to pull some more. This is a basis for success with many people; sometimes it works.

One of the most undesirable conditions that exist, in my estimation, is the man on the edge, too capable to demote but not capable enough to promote. Impress upon the student that he should start out with a lot of ambition and a lot of interest created in his work. He should never let his ambition and interest recede if he wishes to become successful and maintain the standard of success that he is setting for himself. Impress upon him the necessity to work hard, learn a lot of jobs, and get a lot of experience.

One particular essential that many Tool Engineers are lacking in, is that of figuring correct capacities on machine line-ups. Machine capacity is that function in the mechanical division in which they arrive at the number or type of machines required to produce an anticipated schedule in a given elapsed time. Many errors are made in the original purchase of equipment in that the Tool Engineer does not give sufficient consideration to the delay factors involved which consist of:

1. Loss of scrap,
2. Tool changes,
3. Set-up time, if more than one job is run on the same machine,
4. Personal delay of the operator.
5. Down-time or maintenance required on the machine.

These delay factors are most important because the loss is definitely lost to production and cannot be made up except through overtime and when three shifts are being worked it leaves only Saturdays and Sundays to pick up the delinquent production at time and a half or double time, causing units to be produced out of inventory balance and becomes a serious condition. If there are a number of machines on the same operation, delay factors can be figured closer because the probability of all machines being down at once is remote, therefore, with four machines, if one is down 75% of the production can be made, and if two are down 50% can be maintained, etc. The capacity problems just mentioned, I find to be very prevalent among our engineers and one of which we have found to be very necessary to review carefully when purchasing new equipment. It is true that the engineer cannot spend money to cover exceptions rather than

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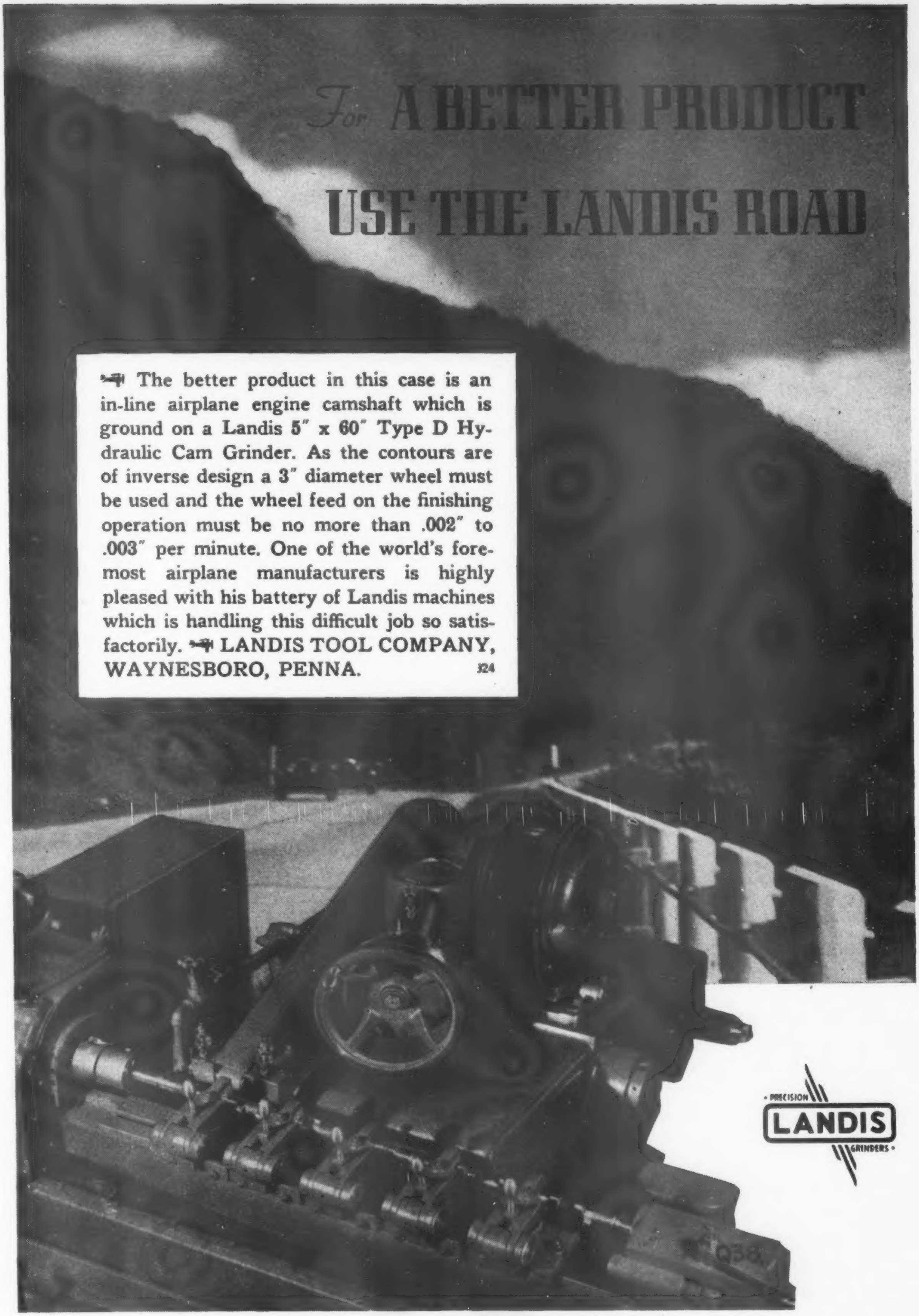
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PRECISION LANDIS GRINDERS

a rule, but considerable judgment must be utilized in providing sufficient equipment, as "the show must go on." Tool Engineers are prone to regard close capacity too literally and do not give consideration to net production at the end of the day. Floor to floor time on one piece is not a solution. Eight or sixteen hours or even a week's experience will really prove what the machine is capable of. Figuring correct capacities is the most serious complaint that we have and one which should be given considerable study in college. Experience naturally lends toward correcting this fault.

Intelligent Report Writing Important

Intelligent report writing is a requirement that very few Tool Engineers possess. The inclination and ability to compile and write a comprehensive report is highly desirable for Tool Engineers holding responsible positions in industry. The main reason that they do not possess the qualifications and ability is the fact that they do not allot sufficient time and effort to actually learn how to write an intelligent subject analysis. Anything that we realize we are not capable of doing well, we are, as a rule, reluctant to attempt; therefore, one of the reasons why a satisfactory analysis is hard to obtain. I am not suggesting it as advisable to attempt to establish a standard on how they should be written because executives requesting reports demand different methods of compiling them. The engineer should be taught to know the reader for whom he is making up the analysis and respect the manner in which he wishes the information submitted. He should be certain that he is familiar with what information he desires to obtain. The person compiling the information should have no fear of the reader; he wants the correct data whether it pleases him or not. They should never be written to fit what the au'hor knows or surmises is the reader's impression of the data asked, but in all cases submit facts. The purpose of a report is to convey ideas, facts, and figures, and should be done with detail that will insure clear and effective communication to the reader. Sometimes this can be done with figures, maps, diagrams, or graphs. A common mistake is to submit an analysis which may result in revolutionary changes and in which the engineer fails to issue a warning on how other departments, divisions, or individuals may be affected. I believe that this is a subject that could be concentrated on in college so that students could do a better job, and it should be impressed upon him that an analysis is, in practically all cases, information from which someone wishes to base his judgment to arrive at a correct decision; oft-times this decision may involve hundreds of thousands of dollars.

Cost is the vital problem that confronts every manufacturer. Some Tool Engineers are prone to ignore it, hoping that they are not excessive, whatever they may be. Others make an exhaustive study and comparison and know where they are going in their tooling. A knowledge of cost is essential so that the engineer is able to reveal weak spots in manufacturing practice. The importance of them and how to control them should always be uppermost in his mind; this can be drilled into him in college.

Education a Continuing Process

I note a statement to the effect that education begins the day one is born and carries on the entire life with the individual. This is most true and the individual should be schooled in this fact and impressed that his education must never cease.

It is a fact that apprentice students, over a period of years, seem to possess more ambition than that of college graduates. I think it worthwhile that you educators here make it a point to solve this condition to see if the ambition built up by the apprentice could not permeate your college students.

We have a plastic department at our plant which is manned entirely by apprentices. I have never seen better quality or quantity work than that produced by these boys and the enthusiasm worked up among themselves is most satisfactory to behold. Some of them have come to my office and even to my home with suggestions as to design and improvements. I just wish some of our graduate engineers would tackle everything with the same ardor and enthusiasm.

A statement has been made as follows: "you, as employers of Tool Engineers, and in the large part as expert engineers yourselves, expect us in education to do the very best job possible in providing you with young men properly equipped to enter your field. We as school people feel that we have a long way to go to do the job properly." As previously stated, you are providing us with men properly equipped technically but in some cases lacking practical experience which is our problem as well as yours. Give us young men who have been drilled to be ambitious, analytical, cooperative, observing, and imbue them in your schools with the desire to be energetic and constructive and do not leave all of the stated qualifications to us to teach and we will be well satisfied with your college endeavor. If the student is a misfit, discourage him early; do not let him graduate with capabilities and skill on the border line and leave the responsibility to industry to dampen his enthusiasm, after he has built up high hopes; this dampening may result in a life time of failure. I note also in the same paper, recommendations that this be covered and selections properly made but there is some question in my mind as to how carefully the recommendations are followed out.

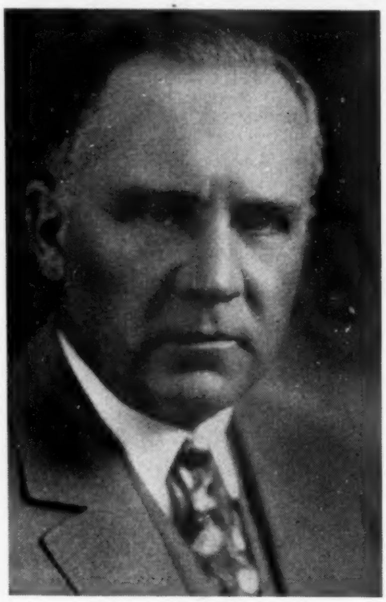
Most of the traits that I have discussed can be improved without expenditures for supplies or equipment. All that is required is more personal study of the individual and a plan carried out that will help him.

Some of the items and personal traits covered, you, as educators, may assume as Management responsibility and a certain percent of them, at least the final polishing off, are and can only be taught as they come under our supervision so that we can point out their errors, however, we do not believe one has been mentioned but what the background for its importance can be started in college studies. We have always felt that instructors in schools do not give sufficient study and thought to the student's characteristics that are a detriment to him and his employers. Perhaps the instructor does not have sufficient time, due to the number of students, or perhaps he has never tried to build up a hobby of developing corrective measures in the individual's personality; however, we as supervisors have to find time. I find this most interesting and obtain more satisfaction out of it than anything else that I do. Discharging or demoting a man in industry by Management, or allowing him to drift through college with no outstanding accomplishments, is the easy way out for both the factory executive and the college instructor. Much will be gained by you and me in endeavoring to improve the man by personal contact to the point to where he can develop into an asset to industry and a more desirable student while in school. What greater satisfaction is there than a job well done, particularly when a fellow workman or student is developed by promoting ideals in his make-up that will result in greater achievements and promotions for him. These are the results of satisfactory service to his employer.

Production Perspectives

News of Mass Manufacturing from Everywhere

President Roosevelt's appeal for $1,182,000,000 appropriation for home defenses accentuated the **need for preparations against armed forces in this country.** At the same time the very cause that brought emotional selling into the stock market will furnish the very cushion for business. **Spending of millions for airplanes and other war necessities will mean employment to many hands.** With the spread of government contracts coupled with expected heavier purchases here by the Allies, the nation's industrial machine is likely to be stepped up several notches in coming weeks. Some observers believe that considerable of this business will be passed around among the smaller companies. The big plants, of course, will receive all of the work they can handle. **Airplane contracts are expected to throw much business** to **the Cleveland area where 117 aircraft parts makers are located.** These machine tool statistics show there is a **$300,000,000 backlog of orders for that industry. Companies include Eaton Manufacturing, Thompson Products and Cleveland Graphite Bronze. Van Dorn Iron Works has been making armor plate.** The **machine tool makers including National Acme, Foote-Burt, Warner & Swasey and Cleveland Automatic** which have been busy for months are likely to see operations continued at a high rate. **Suppliers of bolts and nuts such as Lamson & Sessions, Ferry Cap, Cleveland Cap Screw** and others in that class as well as **National Malleable and Steel Castings Co.,** the steel companies and the electrical manufacturing concerns **should be among the plants to feel the war demand.**



Charles H. Johnson, Executive Vice President and Director of Gisholt Machine Company, Madison, Wisconsin, died recently at the age of 58 years. His entire life was spent in the machine tool industry, having started to work for Gisholt Machine Company as a machinist in 1897 while he was still in his teens. In 1918, he was promoted to a vice presidency in the company. In 1932, he became Executive Vice President. Mr. Johnson was well known here and abroad as one of the outstanding personalities in the machine tool industry, in which he had countless friends.

Orders amounting to about $70,000,000 for munitions and war supplies have been **placed in Canada by the British supply board since last September,** and **further contracts aggregating $17,000,000 will be awarded "very shortly," an official statement said April 17 at Ottawa, Ont.** Appropriations for purchase of war materials and other supplies in Canada for the United Kingdom in the first year of the war amount to $445,000,000, approximately $1,250,000 a day. Only a relatively small portion of the appropriation has been spent because the conflict so far has not brought the consumption of materials anticipated and British production has been uninterrupted, it was said.

The **United States can produce all its own rubber** from its oil wells, **Dr. Gustave Egloff, Chicago petroleum scientist, told** the **American Institute of Chemists May 18 at Atlantic City.** The institute presented him its annual medal for his fuel research. The **potential supply of synthetic rubber** from home oil wells, Dr. Egloff said, **was 200,000,000,000 pounds,** or nearly **200 times more than the amount of natural rubber used in this country last year.** Furthermore, he added, it would not be necessary to wait 10 years, as would have to be done in getting sufficient rubber from plantations proposed to be set up in South America. The synthetic rubber processes are already in operation, and there are several standard refinery processes which yield the raw materials for rubber. **The American oil industry, he said,** also **could produce "any conceivable amount" of the basic materials for the high explosives,** picric acid, T.N.T. and trinitroxylenes, **and still have enough gasoline left over to be more than sufficient for any form of transportation on land, sea or air.** The entire world production of crude oil since its discovery would not fill a cubic mile hole, he said, adding that this was an insignificant volume compared with what nature must have produced and still is producing.

(Continued on page 84)

A.S.T.E. Machine and Tool Progress Exhibition Scheduled for Detroit next March

The week of March 24th to 29th inclusive has been selected for the 1941 Machine and Tool Progress Exhibition. The exhibition will be held in conjunction with the A.S.T.E. annual convention in Detroit and will be held at Convention Hall, as were the spectacularly successful 1938 and 1939 shows.

It is expected that the 1941 show will surpass the splendid 1939 show, although the latter developed a total trade attendance of over 70,000.

A. G. Hansen, a 50-year Gisholt employee, discusses turret lathe tooling—of utmost importance, these days—with his son, C. E. Hansen; a father-and-son team with 71 years of service to their credit.

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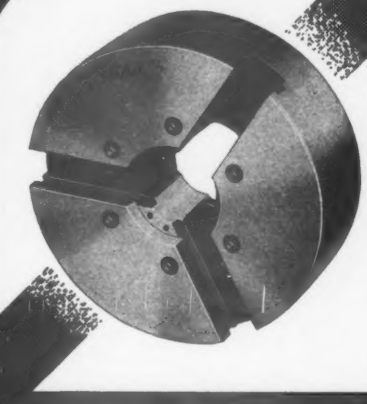
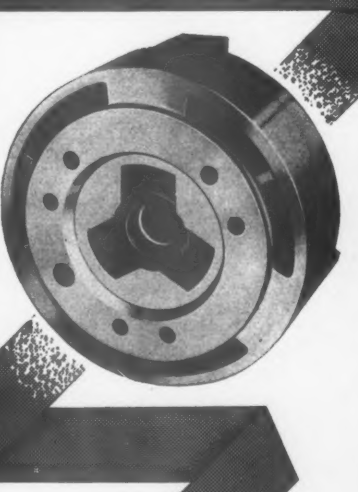


ONE-PIECE STEEL BODY



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... A. S. T. E. DOINGS ...

By IRWIN F. HOLLAND

HARTFORD Chapter held its regular meeting, May 6, and what a meeting it turned out to be. Originally, the program called for an Aeronautical night but it went further than that, for which we are thankful to our local Chairman, Fred Woodcock. We had many of the big-wigs of the United Aircraft with us (probably because Fred himself is one of their executives).

The main technical address was delivered by Arvid Nelson, General Manager of the Hamilton Standard Propellers Division, who traced the development from personal experiences of the aeroplane propeller. Mr. Nelson gave a most interesting talk, supplemented by slides. Mr. Raycroft Walsh, who was elevated that same day to the position of Senior Executive Vice President of United Aircraft, gave the introductory address. The Hamilton Standard Division presented an excellent educational exhibit featuring the latest type of fine feathering adjustable pitch propellers.

To make the evening more aeronautical, we persuaded (and it didn't take much persuasion, as these boys love their hobby which may well become their life work) the Model Aeronautical Engineers of Hartford to exhibit a number of their working models. Among the exhibitors were two National champions, one New England, one State, and one City champion. The program looked so attractive we decided to bring our boys and so it was officially designated as Father and Son Night.

Mr. William Purtell, former director of the Model Aero Club, spoke briefly explaining its functions, aims and activities. d'Arc, our hardworking but always genial National President, gave a brief talk covering our outstanding achievements and his prophesies for our further successes. Ray Morris outlined some plans which he is working on, for the Chapter to render scholarship aid to trade school boys who are ambitious to become Tool Engineers. Fred Woodcock, of course, ran the show and there was another and surprising short talk by Henry Moore, our usually silent and self-effacing Vice Chairman. We had about 200 for dinner and an extra 100 afterward. Mr. Clayton R. Burt, President of Niles-Bement-Pond, who has always taken an active interest in the Society, was present.

But we must add the dessert to the dinner. On May 15, Hartford held its third annual spring outing at Wampanoag Country Club. In the afternoon there was a golf match with teams from Worcester, Springfield and Hartford competing for the New England cup which was put up for competition by the Hartford Chapter this year for the first time, and will be competed for annually by teams from the New England Chapters.

Four more chapters of A.S.T.E were added last month, bringing the total to thirty-six. In the year ending in May, a total of thirteen new chapters was added, and the membership of The Society was increased by well over fifty per cent. Newest chapters are at Binghamton, New York; Brooklyn, New York; Columbus, Ohio and at Indianapolis, Indiana.

The Hartford team was the winner and was composed of the following members: Henry Rockwell, Wilson Fenn, Bob Grant, Alton Green, Stanley Brandenburg, and A. E. Englund. The Kicker's handicap was won by J. F. Byrne, F. O. Hoaglund and J. Balciunes, all of Hartford. Sweepstakes winners were A. C. Wolz, P. Badgley, R. K. Davis, Jake Dunnell and Wilson Fenn. William Grinold and G. Sundquist finished first and second respectively in the putting contest. J. Van won the horseshoe pitching event with K. F. Thomas second. Bob Grant presented the prizes.

The dinner was attended by more than 350.

During the morning, the Chairmen of the New England Chapters with their Vice Chairmen met with d'Arc., the National President, to discuss problems which are common to all the New England Chapters. Those present included Frank Curtis, Springfield Chairman and H. Braig, Vice Chairman; Ray Cole, Worcester Chairman and John Lundegrin, Vice Chairman, as well as the Hartford officers.

Greater New York Chapter, No. 34, Organization meeting was held on May 8. Approximately 175 members, prospective members and friends of American Society of Tool Engineers were present in an Auditorium of the Pratt Institute for the charter meeting.

Mr. C. C. Gorham opened the meeting. The meeting was turned over to Mr. A. H. d'Arcambal, who introduced Tom Orchard. The following were introduced: Messrs. Hall, Ryno, Thompson, Ryrnes, Duncan, Gorham, Schwister, Brady and Schiller. Mr. d'Arcambal thanked the organizing committee for its splendid work and mentioned the results of other Chapters which have recently been chartered.

Mr. Lamb discussed the benefits of

(Continued on page 60)

Detroit A.S.T.Eers really turned out for the May meeting, which was held at the Ford Motor Company's huge tool and die shop—probably the largest and most up-to-date of its kind in the world. Below is shown but a portion of the large crowd which attended. Photo—Courtesy Ford Motor Company.

Here you see Boston Chapter's installation of officers at the Walker Memorial auditorium in the Massachusetts Institute of Technology. On the left with hand upraised—A. D. Forbes, Chairman. Next C. A. Lockwood, Vice Chairman. Third, W. W. Young, Secretary. Fourth, John W. Geddes, Chapter Treasurer. Facing on extreme right, is A. H. d'Arcambal, National President, American Society of Tool Engineers.

PROVIDE THE *Necessary* HIGH SPEEDS FOR YOUR SMALL END MILLS

Milwaukee

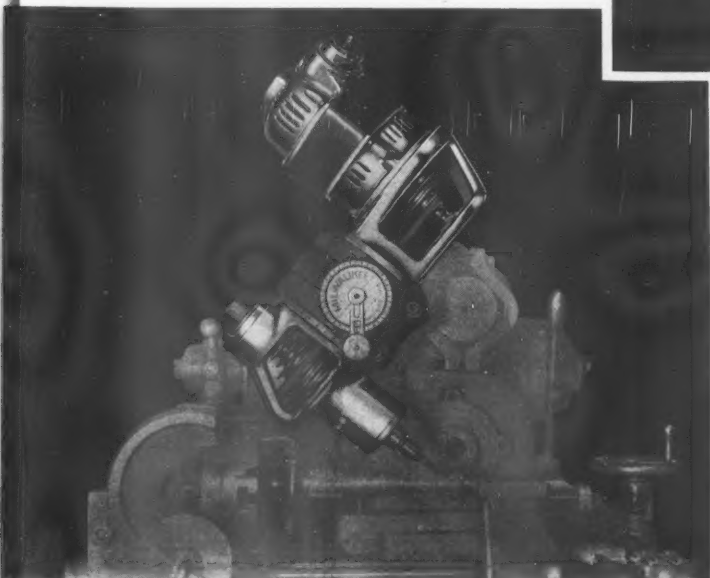
(FORMERLY DALRAE)

HIGH SPEED MILLING ATTACHMENTS

The MIDGETMILL →

MILLS . . DRILLS . . BORES

Designed to get the most from small tools by providing the necessary high speeds needed for their most efficient operation. Completely universal — adaptable to any milling machine — fast, safe and easy to set up. Special "Thou-Meter" device gives a continuous reading in thousands of the depths at which you are working. Get full information, send for bulletin.



The Midgetmill and Speedmill were formerly produced and sold under the name of DALRAE by the DALRAE TOOLS CO., Syracuse, New York.

← The SPEEDMILL

FOR MILLING

Closer sizes — better finish — accurate end mill speeds up to 3200 R. P. M. — a great time saver — these are only a few of the many advantages of the Speedmill.

A compact, well-balanced attachment adaptable to any and all types of milling machines.

• • •

Send for bulletin, describing the Milwaukee Midgetmill and Speedmill — their many advantages in end mill operations.

E. J. KEARNEY

THEODORE TRECKER

KEARNEY & TRECKER Corporation

Milwaukee, Wisconsin, U. S. A.

Handy Andy Says —

Had coffee "and" at a "Swedish Kitchen," the other eve. When I mentioned my name the buxom hostess said she knew me well a/c one of her friends has the same monicker—A. E. Rylander. Only, his name is Axel and, as I get it, he's one of the heavies at Warner & Swasey, Cleveland. It happens that we both lived in the same town—Providence, R.I.—for a number of years, and while we never met, I heard a lot of fine things about him. Now, after twenty years, we are brought together, vicariously, by a mutual acquaintance. Personally, I congratulate Warner & Swasey and Axel on the connection; a fine concern and a swell guy work well together. Please look him up, you Clevelanders, and give him my regards——and while you're at it, tell him about the A.S.T.E. Also, you might say that Mrs. Judith Nordstrom (of Sw. K.) sends greetings: she'll have "lutefisk" for him next Xmas if Winston Churchill can chase Fritz out of Norway.

Speaking of lutefisk (you'll never fathom the way my mind works) reminds me that somebody offered a million for Dolph Hitler. Personally, I wouldn't flatter the guy that way, but I'd give a year of my life for five minutes in a locked room with one Major Quistling. And I wouldn't have to prime on spinach, either. But then, 'tis rumored that somebody shot the so-and-so, which was much too good but must have been quite a relief to Hitler. A traitor is equally odoriferous to kin and buyer alike. All of which brings up the war, got really going at long last. And to those boys who have asked me how I feel about American neutrality now that Scandinavia is involved, I say, let's have more of the same. Not that I'm a pacifist; it's just that war is so futile, really settles nothing. Look back to Versailles! And after all, it's rather nice to putter in the garden without wondering if the airplane droning overhead is going to drop a pineapple on your neck.

▼ ▼ ▼

Personal and general preference to the contrary, however, I'm afraid that "M" Day is just around the corner. As this is written (May 5th) report has it that U.S. can embark two million troops at short notice—and why? Well, I'll give you three guesses whose side we'll fight on, Father Coughlin and Gerald Smith to the contrary. And just when the question of who won the last war is almost settled!

Now, whether the future bodes war or peace, we must win both, and our only assurance that we'll win either is in absolute preparedness. In this, we can take a lesson from Europe. Finland was prepared, retained independence (if at a price) despite overwhelming odds and a deluge of sympathy, and Sweden has been prepared, is still neutral and independent. Denmark was disarmed, helpless to resist, and while Norway could have resisted, the Norsemen's guns were spiked by traitors. And don't think for a minute that we haven't plenty of Quistlings right here in the U.S.A., even as we had a Benedict Arnold in '76.

▼ ▼ ▼

I'm not a very good hater, and I judge Germans and British alike by their fine representatives in our own A.S.T.E. However, I do not subscribe to Nazism which, in my opinion, is a pseudo socialism quite unlike the social democracy of my native Sweden. What Hitler thinks he can improve in countries that rank a close second to the U.S. in standards of living is beyond me. Perhaps the guy wants first hand information on how culture rather than Kultur works, the way the ancient Romans got it from the Greeks.

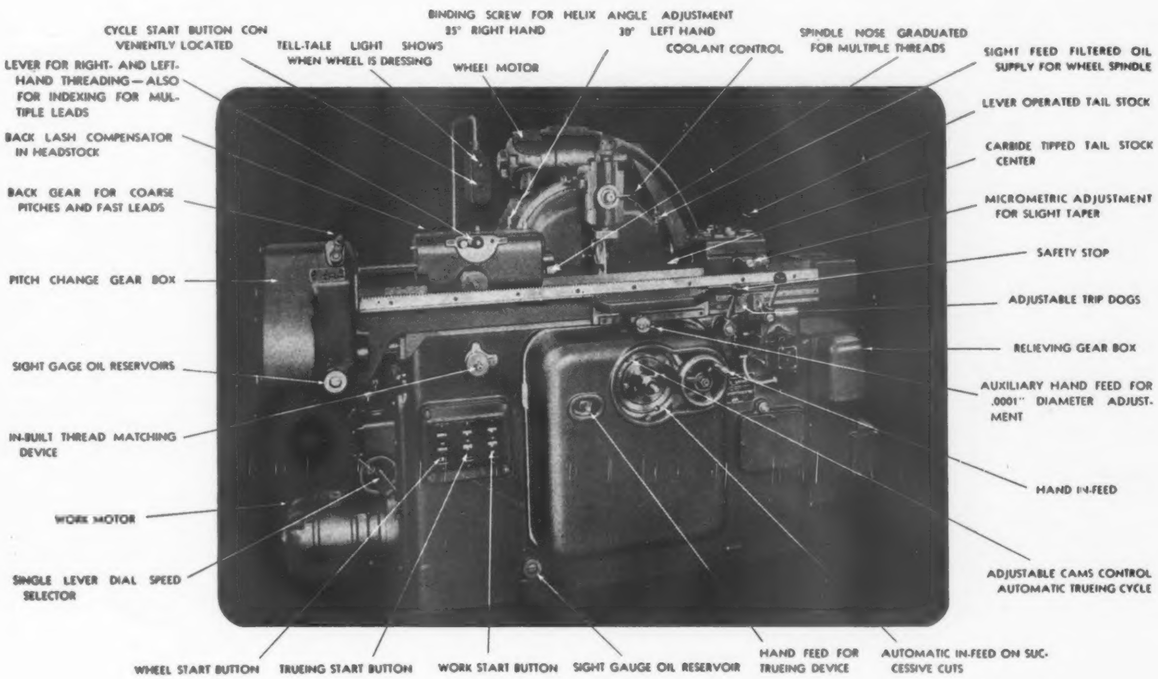
Judged by facts, not opinion, Germany has taken every trick in the game so far. But Germany has been planning this war since the end of the last, and it's not Hitler who is the moving spirit,

(Continued on page 48)

STUDY THIS
photograph for profit

A careful examination of LABOR, TIME and MONEY-SAVING FEATURES of Jones & Lamson Automatic Thread Grinders has convinced many manufacturers of their Profit Possibilities.

Their purchases, after consultation with our engineers, more than justified their convictions. In some cases greater economies were effected than we had estimated, and in all cases Jones & Lamson Thread Grinders demonstrated their earning power.



AUTOMATIC TRUEING, AUTOMATIC COMPENSATION FOR THE AMOUNT DRESSED OFF THE WHEEL, AND AUTOMATIC SIZING are all *IN-BUILT* features of Jones & Lamson Automatic Thread Grinders.

Where the cutting time permits, ONE OPERATOR CAN RUN TWO OR MORE MACHINES, still further reducing grinding costs.

Manufacturers who have Threading Problems on hardened and ground steel parts, or other parts requiring precision grinding may well TURN LOSSES INTO PROFITS by consulting Jones & Lamson Engineers.

Our NEW Thread Grinder Catalog will be sent to you upon request.

JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S.A.

MANUFACTURERS OF: SADDLE & RAM TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . TANGENT AND RADIAL, STATIONARY AND REVOLVING DIES AND CHASERS

HANDY ANDY

(Continued from page 46)

but the German officer caste. To them, the Vaterland comes first, be the ruling head Kaiser, Fuehrer, or a clay image. Preferring peace and construction to war and destruction, we may deplore their misdirected genius, but we cannot deny the efficiency of the war machine which they have evolved. Because of it, Germany has become—temporarily at least—the master of Europe, and as things stand, it is well guarded from interference. The Westwall, a friendly Italy, a quasi-friendly Russia, the crags of Norway and the expanse of the Baltic, the intangible but definite barriers or neutral minorities caught between the horns of dilemma. Truly here is connivance and preparedness, but not for peace.

England, in direct contrast, was not prepared despite the inevitableness of war, now pays dearly for a sin of omission. Of course, where the head of the Bulldog goes the tail must eventually follow, but who can prophecy the final outcome where a slow but tenaciously courageous bulldog is pitted against the lightning slashes of a feral wolf? Britain still rules the waves, but Germany rules the air, and who can say at this stage of the game that the battleship is obsolete and that the plane is in its ascendancy? Had England been prepared, with planes, guns, munitions and trained soldiers there would have been no Munich, no rape of Czecho-Slovakia, no Blitzkrieg in Poland or an imitation in Finland, no seizure of neutral minorities. And there, gentlemen, is the lesson for America!

▼ ▼ ▼

To stay neutral, to compel respect for our desire for peace, we must be so prepared that an overt act against us would be tantamount to an act of desperation. And if war is forced upon us, preparedness means its merciful expedition. The object of military tactics is to destroy the enemy with the least sacrifice of one's own forces, hence, our army should be equipped 100% with automatic rifles, and if anything, oversupplied with machine guns and anti-aircraft guns. We should have planes to match any enemy armada, should train youth and the middle aged alike in the use of arms. Given all that, we should be able to defer M Day indefinitely; a mere admonishment from Uncle Sam might be enough to deter an ambitious adversary. Unless, of course, war may be used as a clinch nut for a third term.

Now, coming back to England, I've got a way to win the war for them to wit:

An open letter to the Hon. Winston Churchill, London-on-Thames.

My dear Winston:

I see by the papers that you are lambasting your peers for their muddling, and I'm inclined to agree with you although I wouldn't put it that strong myself a/c being caught in the middle, like. Neutral, you know. But I hear that you're having tough sledding getting guns, planes and such over to the boys in Norway, which is getting pretty close to my home town. And somehow, I think you've overlooked a bet. Ever hear of this American Society of Tool Engineers? Well, we're neutral, of course, this side of the border, but there's a Chapter up in Toronto, Canada, (that's in your jurisdiction, isn't it?) and those boys have all the vim, pep and get-up-and-go that is inhibited by folks this side of the Big Pond. Besides, they have a lady T.E.—Philippa Rowe, her name is—who they say can show Herr Messerschmitt a trick or two about airplanes.

Now, Winston (call me Andy) I suggest that you put all your production problems up to that gang. You'll get results, sir! Why say, in the time that you'd take to make preliminary sketches for a plant they'd have the last can installed in the washroom and the rest in use, while the plant would be turning out guns, shells and planes lickety split the way we make parts for Ford, G.M. and Chrysler cars. Speed, sir!—and interchangeability to the Nth. degree of perfection. Well, Winston, there's your bag of tricks.

With kindliest personal regards to you, sir, I am

Yours for action,
Handy Andy.

290
50
20
60
420
20
395

836
100
[illegible]
1061

New No. 22-L
Table size: 45" x 10".
Feed range: 26" x 11" x 17".
Ram movement: 19".

NOTE THIS: With the simplest types of milling cutters and without attachments, an operator can mill vertically, horizontally or at any angle throughout the full range of the table of a Van Norman Ram Type Universal Milling Machine. Set-up time is cut from 20% to 50% . . . output increased and costs lowered. The ease of adjustment and ability of Van Norman Universal Millers to handle a wide range of work will help you to get more and better work thru your toolroom, pattern shop or production departments. Five models — precision built, heavy, rigid — to meet your needs from heavy work to the most sensitive. Write for Bulletins.

Van Norman Machine Tool Co., Springfield, Mass.

NEED FOR TOP RAKE

(Continued from page 9)

The necessity for calculation of tools without the inclined angle of top-rake cutting edge is generally understood and extensively used since the "requirement of calculation" cannot be avoided. The system does not involve extensive formulae and ordinarily is inexpensive since tabulations easily obtained reduce the time required for tool correction calculation. The usual calculation for corrections of circular and flat form tools is caused by the requirement of a pressure angle.

During the construction of a flat form tool, the toolmaker will measure the profile shape at right angles to the pressure angle surface. The profile shape of a circular form tool will be measured across the different diameters of the tool. The steps of the profile shape of either circular or flat form tools, will not be the same as the steps on the product. When the cutting edge is plain or non-rake, the differences between the step on the product and the relative step on a tool is slight for shallow steps and increases progressively as the depths increase. Although these facts are also true when the cutting edge is inclined for top-rake, the differences between the product and tool relative steps will not be the same nor in the same regular progression as the steps increase.

Calculating Top-Rake Tools

Non-rake tools involve a comparatively simple system of calculation for corrections, whereas the incorporation of top-rake introduces complications requiring a lengthy system of calculation by the usual method of trigonometric formulae.

Any mathematical system as ordinarily used in connection with top-rake for form tools, requiring the use of a dozen or more steps of calculation, is objectionable due to the following reasons:

(1) The time required for lengthy calculations is an overhead engineering charge which cannot be ignored in the manufacturing cost of an article.

(2) When mathematical accuracy of results is to be definitely assured, the results obtained by one individual must be subsequently checked by another individual. This, of course, doubles the engineering cost for calculations.

(3) It is entirely possible that several individuals may use their own ideas of calculating to obtain individual correct answers, which may be closely or proportionately related as a series. These cases cause differences of opinions which develop costly arguments.

(4) A slight mistake or mistakes during one or more steps of a multiple step formula cannot be ascertained until the final answer is obtained. Very often the final answer may logically seem correct. However, a double check is required to satisfy conflicting answers. This again, of course, is expensive.

(5) Mental fatigue is considerably less discernible than physical fatigue, therefore, the loss through mental fatigue is costly, but not so obviously shown.

My many years of experience with the subject of top-rake for form tools also included the trials and tribulations of calculation systems involving proportionate enlargements, mechanical levers and mechanisms. The systems mentioned are expensive in first cost and cumbersome to use. The drafting or layout system is objectionable because of the inconveniences in addition to the human element of making a mistake in taking the readings. The use of formulae is objectionable because of the reasons previously stated and is usually the cause for the retarded use of top-rake. Knowing the benefits of top-rake and the fact that it was avoided because of engineering cost, I determined to devise a system which would eliminate lengthy calculations and involve only common arithmetic and, in many cases, to obtain the corrections by visual inspection of the prepared tables. It is safe to say that the use of the tables shortens ordinary calculation time by 75 per cent.

"Correction Figures"

The system consists of tabulated forms known as "Correction Figure Tables" which are to be applied to either circular form tools or flat form tools. The tables will transform a rad-

(Continued on page 74)

SMALL LOT PRODUCTION

(Continued from page 21)

heavy turret attachments, (2) setting of the cutting tools to size by means of trial cuts and (3) setting and adjusting stops.

It had been my intention, in bringing out some of the methods we are using to reduce set-up time, to touch upon the "fixed" or "permanent" set-up principle, wherein the heavy turret attachments are so mounted, that frequent changes are unnecessary. In a current issue of a trade magazine this principle is very thoroughly covered with many other helpful ideas, and as most of you have probably read the article, I will not take up your time by further discussion on it.

Next we find considerable time required in setting the cutting tools for size and for the setting and adjustment of stops. Where the work is of a repetitive nature, considerable time can be saved by the use of set-up pieces which are machined in accordance with the operation to be performed. This method will greatly reduce the number of adjustments and trial cuts which are usually required.

Tool Maintenance

Cutting tool maintenance is apt to present us with one of our most perplexing problems, especially if the operator grinds his own tools, because we must include not only the grinding of the tools in this subject, but also the training of the operator in the correct usage of the tools in cutting the various materials. As new cutting materials are introduced, and as the engineering requirements gradually lead to the tougher machining alloys, the operator must become accustomed to the different action of the tools and material under cut, the increased cutting speeds and feeds, and the different methods of grinding the tools. The importance of correct tool grinding cannot be too highly stressed, and it is recommended that cutting tools be machine ground, and honed in the toolroom; especially if carbide tools are used. It is, also, readily appreciated the advantages of providing an adequate supply of tools for replacement as required.

Minor Causes of Lost Time

The minor causes of lost time, such as loading and unloading the work and checking sizes, sometimes require attention. Although deficiencies in this respect are more easily corrected, they should not be ignored. One of the chief factors in decreased production and high scrap loss is fatigue, or, a tired operator. Where large work is involved, an adequate material handling device should be available to relieve the operator of the manual effort required in loading and unloading the parts, his working space should be kept cleared to allow him natural freedom of movements, his work should be placed so as to be accessible with the minimum amount of effort, snap gauges, plug gages, depth gages, templets, etc., should be provided where possible to eliminate the eye strain and mental calculations sometimes necessary with the other types of measuring instruments and all other working conditions should be of the best to insure the proper application of good tooling.

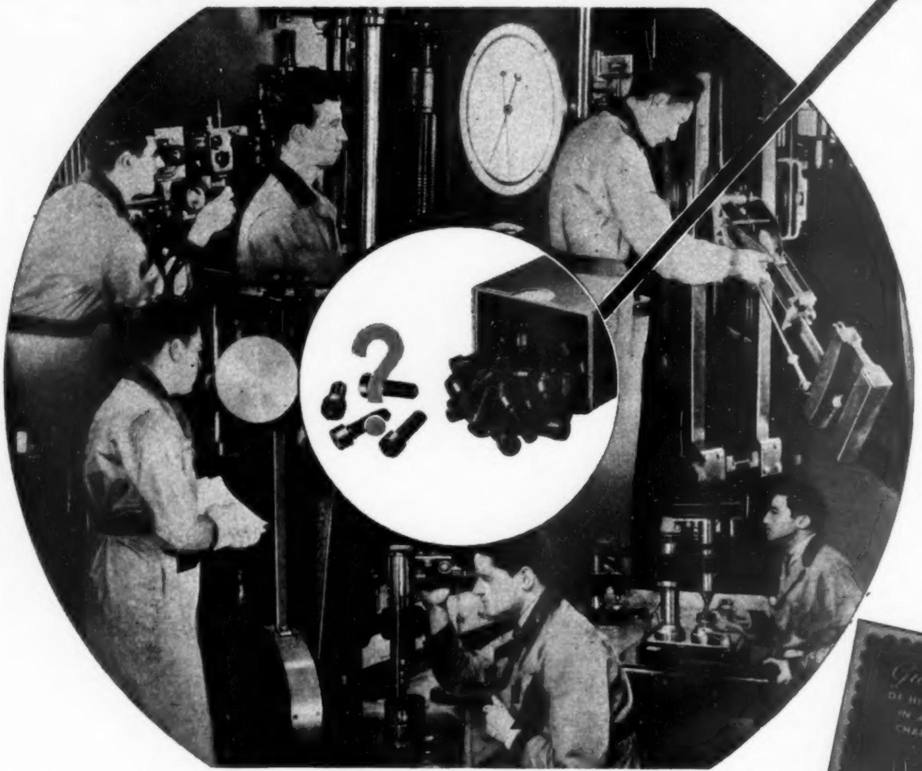
Miscellaneous Factors Which Affect Production

Let us now briefly touch upon another phase of this subject on which very little is ever said and which, in my opinion, is of equal importance to the design and manufacture of the machines and tools. That is the direct application of them. No matter how carefully designed and made they may be, their cost cannot be justified until they are put to work, as intended, by the development engineer. If the cutting speeds used are too high, cutting tools require too frequent grinding, thus prohibiting the operator to maintain his normal working speed; if too low, there is the resultant loss of production; if the tools are so positioned to cause interference prohibiting the use of multiple cutting, if otherwise desirable, there is additional loss. We rarely find an operator who, if he is charged with scrap losses, or is working on an incentive system of wage payment will do much experimenting to determine

(Continued on page 70)

NO "Doubtful Few"

CAN SLIP THROUGH



Parker-Kalon's unique Quality-Control Laboratory rules out "doubtful" screws that threaten fastening jobs

PUT Parker-Kalon Fastening Devices on your assembly line and you'll end troubles with the "Doubtful Few" . . . those few imperfect units in a box that won't drive properly or make satisfactory fastenings. Such screws are ruled out by Parker-Kalon's scientific "3rd degree" of tests and inspections.

A $250,000 Quality-Control Laboratory that has no counterpart in the industry has made it possible to hold Parker-Kalon Hardened Self-tapping Screws, Socket Screws, and other fastening devices to higher standards than ever before could be attained. Precision equipment controls every step in production. "Doubtful" units *can't* slip through!

Specify PARKER-KALON on your next order . . . get fastening devices guaranteed by the most modern plant in the screw industry. Parker-Kalon Corp., 190-198 Varick St., New York.

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of . . . .*

Hardened Self-tapping Screws

Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws

CapScrews, SetScrews, Stripper Bolts made to a new high standard of quality

Wing Nuts-Cap Nuts-Thumb Screws

Cold-forged . . Neater, Stronger

Quality-Controlled PARKER-KALON Fastening Devices

June Meetings . . .

BOSTON

June 22, 1940—Stag Outing for members and guests. Plans are being made for golf, horseshoe pitching, soft ball, etc.

BUFFALO

June 20, 1940—Dinner at 6:30 P.M., at Wurlitzer Co., Tonawanda, N.Y. Plant visitation with trip through punch press dept., machine shop, plating and buffing, wood mill and fabrication of plastics, also final operations prior to packing.

CLEVELAND

June 14, 1940—Dinner at 6:30 P.M., Technical session 8:00 P.M., at Hotel Allerton—East 13th and Chester Ave., Cleveland.

Speaker: Carl Rollo, Develop. & Research Div., International Nickel Co.
Subject: "Fabrication of High Nickel Alloys."
Coffee Speaker: W. L. Listerman, Federal Bureau of Investigation, U.S. Dept. of Justice.
Subject: "Behind the Scenes with the F.B.I."
Reservation: Wm. Reiff, Jr., 626 Penton Bldg., Cleveland, Ohio.

June 22, 1940—Second Annual Golf Party at the Lake Forest Country Club. Members and their wives and guests are invited. Facilities for bridge, soft ball, boating and fishing will be provided for those who do not play golf.

Dinner: A steak dinner will be served at 6:00 P.M.
Reservations: Call J. R. Fitzsimmons, Die Supply Co., 1390 E. 30th St., Cleveland, Ohio, Ch. 6818.

DETROIT

June 13, 1940—Dinner 6:30 P.M., Ft. Shelby. Technical Session 8:00 P.M.

Speakers: O. W. Habel, Factory Mgr., G. G. Kearful, Methods Engineer, Saginaw Steering Gear Division of General Motors Corp.
Subject: "Machine Design and Motion Economy," accompanied by movies.

ELMIRA

June 14, 1940—Dinner 6:30 P.M., Langwell Hotel, Elmira.

Speaker: C. C. Stevens.
Subject: "Hydraulic Feeds."
This is to be a joint meeting with A.S.M.E.

MILWAUKEE

June 13, 1940—Dinner 6:30 P.M. at Hamman's, 3865 N. Richard St., opposite Seaman Body Plant. Delta Mfg. Co. will hold Open House and there will be a plant visitation.

MOLINE

(Tri-Cities)

June 30, 1940—Dinner 6:30 P.M. at the Ski-Hi Ballroom, Le Claire Hotel, Moline, Ill. This is to be a father and son get-together.

Speaker: E. G. Crane of McCaskey Register Co.
Subject: "Cutting Tool Expense with Modern Control Methods."
Added Attraction: "Know Your Money," a moving picture film furnished by the U.S. government.

(Continued on page 56)

NEW YORK-NEW JERSEY

June 29, 1940—Annual Summer Stag Picnic to be held at Doerr's Grove, Livingston, N.J.—10 A.M. to 8 P.M. Many contest and door prizes. Beer and food to be served all day. Tickets for members (includes everything, $2.00). Tickets for non-members (includes everything, $2.50).

PITTSBURGH

June 14, 1940—Dinner 6:30 P.M., Hotel Henry, Fifth Ave. Technical session 8 P.M.

Speaker: R. S. Drummond, President National Broach and Machine Company.
Subject: "Roto-Milling and Broaching Technique."
Reservation: E. D. Gangewere, Care of Westinghouse Electric and Manufacturing Co., Br. 1500.

RACINE

June 14, 1940—Fifth Annual Frolic at Meadowbrook Country Club.

Golf, sports, entertainment, dinner, and two or three speakers will make up the general program of the day's activities.

ROCHESTER

June 12, 1940—Dinner 6:45 P.M. at Todd Union, University of Rochester. Open Forum.

Subject: "Your Tool Problems—Your Answers."
Reservations: C. G. Newton, Stone 2893.

June 22, 1940—Picnic at Point Pleasant, beginning at noon.

Reservations: Call Jake Phillippsen.

ROCKFORD

June 15—Golf Stag for members and guests at Morgan Memorial Golf Course, Beloit, Wisconsin, from noon until 9:00 P.M. There will be prizes, eats and games.

ST. LOUIS

June 13, 1940—Melbourne Hotel, St. Louis.

SYRACUSE

June 11, 1940—Dinner 6:30 P.M., Syracuse Industrial Club. Technical session 8:00 P.M.

Speaker: C. R. Pardee of Crucible Steel Co.
Subject: "Operation of Electric Crucible Furnace for Tool Steel Manufacturing."

TOLEDO

June 11, 1940—Dinner 6:30 P.M., Toledo Yacht Club.

Speaker: C. R. Staub, Michigan Tool Co.
Subject: "Ground Form Finishing Hobbs."
Speaker: Carl Ostrosky, Spicer Mfg. Co.
Subject: "Treatment of Tool Steels."
Reservations: R. H. Mogle, 3722 Leybourne Ave., Lawndale 8783.

NEW SOUTH BEND 10-INCH LATHE

1 - Inch Collet Capacity . . .
1⅜ - Inch Hole Through Spindle
50 to 1400 R.P.M. Spindle Speeds
Screw Threads 4 to 224 Per Inch
Power Cross Feed
Power Long. Feed

1-inch Collet Capacity 10-inch Swing South Bend Underneath Belt Motor Drive Quick Change Gear Tool Room Precision Lathe. Mounted on all steel welded bench. ½ H.P. instant reversing ball bearing motor and 12-speed drive are enclosed in left side of bench.

Hand Lever Draw-in Collet Chuck
For Rapid Production of small interchangeable parts. Permits releasing and feeding bar stock through collet without stopping lathe spindle. Maximum collet capacity 1".

Hand Wheel Draw-in Collet Chuck
For Precision work in the Tool Room, Experimental Department, and Laboratory Shop. Maximum collet capacity 1".

THIS new 10-inch swing 1-inch collet capacity back-geared, screw cutting precision lathe has the time saving features of an engine lathe combined with the sensitivity and accuracy of a fine precision collet lathe. It is capable of the most exacting tool and instrument work, and has the power and rigidity for taking heavy cuts on high speed production operations.

Manufacturing attachments available include hand lever draw-in collet chuck, semi-automatic hand lever bed turret, double tool rest, automatic carriage stop, four-way tool post, oil pan, oil pump and piping.

Tool Room attachments as illustrated include hand wheel draw-in collet chuck, telescopic taper attachment, micrometer carriage stop, thread dial indicator, and collet rack.

ON DISPLAY IN ALL PRINCIPAL CITIES

Boston, Mass. — MacKenzie Mach. Co.
Bridgeport, Conn. — A. C. Bisgood
Baltimore, Md. — Carey Mach. Co.
Cleveland, Ohio—Reynolds Mach. Co.
Detroit, Mich.—Lee Machinery Company
Houston, Tex.—Wessendorff, Nelms & Co.
Los Angeles, Cal.—Eccles & Davies
Milwaukee, Wis.—W. A. Voell Mach. Co.
Newark, N. J.—J. R. Edwards Mach. Co.
New York, N. Y.—A. C. Colby Mach. Co.
Philadelphia, Pa.—W. B. Rapp Mach.
Providence, R. I.—Geo. T. Reynolds & Son
San Francisco, Cal.—Moore Mach. Co.
Seattle, Wash. — Star Machinery Co.
Toronto—A. R. Williams Mach. Co., Ltd.

SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906 479 E. Madison St., South Bend, Ind., U.S.A.

TRADE MARK SOUTH TWINS BEND ENGINE LATHES

INDUSTRIAL REQUIREMENTS

(Continued from page 23)

in connection with telescopes and other work of a relatively high engineering character. Yet, throughout its entire sixty years of history, the company has never been headed by a graduate engineer and so far as I know, never by a member of an undergraduate honor society. In fact, three of the five presidents never completed their high-school education. Both of the original founders of our company were products of the little red school house and they came to be highly regarded in the engineering world not through any high selectivity as scholars in academic rating, but because they qualified under the simple definition by Webster which I cited at the beginning of this discussion.

They were successful managers and they were successful managers of men.

Granted, of course, some other fundamentals of intelligence, there is to my mind no simple qualification for engineering or Tool Engineering or any other form of active life so important as personality. There are in Europe today three men of outstanding personality who so far as I know, are without any academic background. Those three men have today involved the whole world in a tragic circumstance.

I often speculate upon what might have happened if those three men at some point in their formative years could have been in the hands of teachers whose influence might have developed a sound basis of philosophy. It might have directed the great influence of those dictators in a constructive direction, quite aside from any I.Q. rating.

Cooperative System of School and Business

Finally as we look at this prospective Tool Engineer, comes the element of practical training. Again, I pay tribute to the development in education in that I think we have made great strides in a generation in the direction of balanced training of men for industry but there is still unexplored a great possibility of cooperative endeavor between the school and the business.

The industrial trade school and the technical high school have accomplished much and in a few of our colleges the so-called cooperative system of halftime practical shop life against halftime in the school room is decidedly effective. We are currently in a phase of class consciousness which I am sure will diminish but which is for the moment, hampering the best development of this idea. Less and less significance will attach to the scholar per se as naturally qualified for the white collar job—for supervision.

There is much to be desired in the dignifying of labor. From the point of management, I believe there is a growing recognition that in all departments of production the highest type of leadership and ability must be recruited and I am almost willing to predict that in the next several years the opportunities both in latitude and in earning power in the manufacturing end of industry will equal those of any other branch of the business excepting possibly top management. The growing complexity of human relationships in industry will do much to increase the opportunity for the man in overalls.

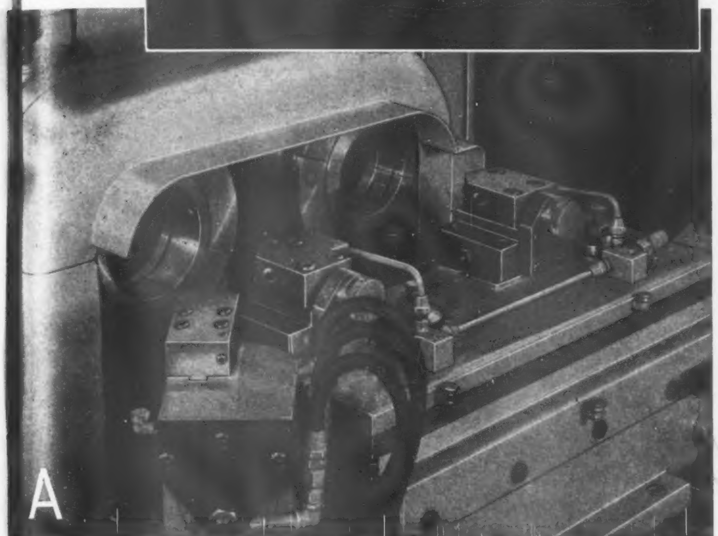
I should like to speak here also of a program which my company is about to undertake in this connection. We believe that the creative genius of the Tool Engineer and the skillful planning of production will be effective only as those people involved in the carrying out of such ideas become effective.

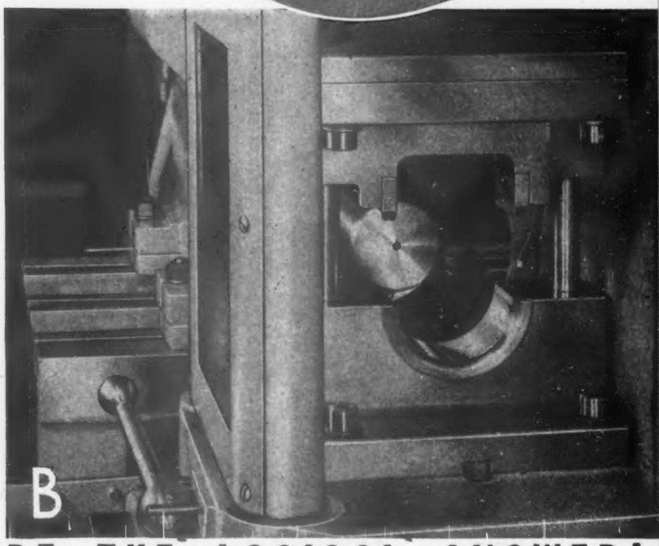
We have been increasingly concerned with the position of the machine operator and particularly the turret lathe operator. As a consequence we are undertaking a form of practical education ourselves and extending it through our entire market field.

There are appearing currently in the press excerpts from, what we regard, as the most comprehensive book on turret lathe operator training which thus far has appeared. It is the culmination

(Continued on page 75)

• WHEN BORING *demands* EXTREME PRECISION





. . EX-CELL-O MACHINES ARE THE LOGICAL ANSWER!

To the supreme standard of accuracy that automobile and aircraft engine manufacturers have brought so effectively to modern industry, Ex-Cell-O Precision Boring Machines have contributed in a practical and outstanding way.

Illustrated here is one of many applications. Indispensable requirements of micro-inch finish are easily and surely met in the machining of half and full bearings for the master connecting rod of a nationally known airplane motor.

Illustration A shows an Ex-Cell-O Precision Boring Machine (Style No. 112C) used for turning the radius and chamfering ends of bearing. In illustration B is shown the same style machine used for the finish boring operation (either half or full bearing). The Ex-Cell-O fixture illustrated is adjustable in clamping pressure necessary to produce the desired result in finishing bearings of this type—pressure anywhere up to 6000 lbs. is available.

These applications are typical of many others that are being successfully made. Numerous modifications are possible.

Wherever precision is a requirement, along with production and economy, Ex-Cell-O Precision Boring Machines enter definitely into the picture. Send details of your boring, turning or facing problem to Ex-Cell-O *today*.

• Ex-Cell-O Style No 112 C Senior Single-End Precision Boring Machine provides an efficient and economical method for handling many types of applications. Use the coupon for information on this and other styles of Ex-Cell-O Precision Boring Machines.

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EX-CELL-O CORPORATION,
1204 Oakman Blvd., Detroit, Mich.

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EX-CELL-O *Precision* MACHINES AND TOOLS

XLO

A.S.T.E. DOINGS

(Continued from page 44)

the American Society of Tool Engineers to the Tool Engineer, telling of the work done by the Society; what it costs; how it is financed, who runs the Society, when and why it was organized. The qualifications for membership were discussed and the current financial statement was read. At the conclusion of Mr. Lamb's discussion the meeting was turned into an open forum. Mr. Lamb answered questions which were asked by many of those present.

Officers of the Chapter were elected as follows: A. J. Duncan—Chairman; Tom Orchard—Vice Chairman; A. J. Schwister—Treasurer; Holbrook Horton—Secretary.

Binghamton Chapter No. 35 held its organization meeting on Thursday, May 9, at the Binghamton Hotel. The meeting was opened by J. Don Reep who introduced the Committee who helped form the Chapter. He then introduced Mr. A. H. d'Arcambal and turned the meeting over to him. President d'Arcambal told about the principles and activities of the A.S.T.E. After a well accepted description of the policy of the Society, Mr. d'Arcambal introduced Ford R. Lamb, Executive Secretary, who described the operation and cost of A.S.T.E. He then introduced several officers and members from Buffalo, Rochester, Syracuse and Elmira Chapters.

After a vote of approval of the Society, President d'Arcambal proceeded to organize the Chapter and held an election of officers, resulting as follows: W. T. Forde, Chairman; Warren Kishbaugh, Vice Chairman; Donald G. Goetchous, Secretary; Walter Hediger, Treasurer.

The **Detroit Student Chapter** held its May 2 meeting at the Abington Dining Room and the Gorham Tool Company. Preceding the dinner "Goodfellowship" was promoted by a request from the chairman asking that each man introduce and make himself known to three or more gentlemen near by. Immediately following dinner the honored guests, Mr. George Demorest and Mr. Aage Ketelsen, were introduced.

Mr. L. C. Gorham, President of the Gorham Tool Company, who acted both as host and speaker, gave a brief "after-dinner-talk" summarizing the history of H.S. steel developments in the past twenty-five years.

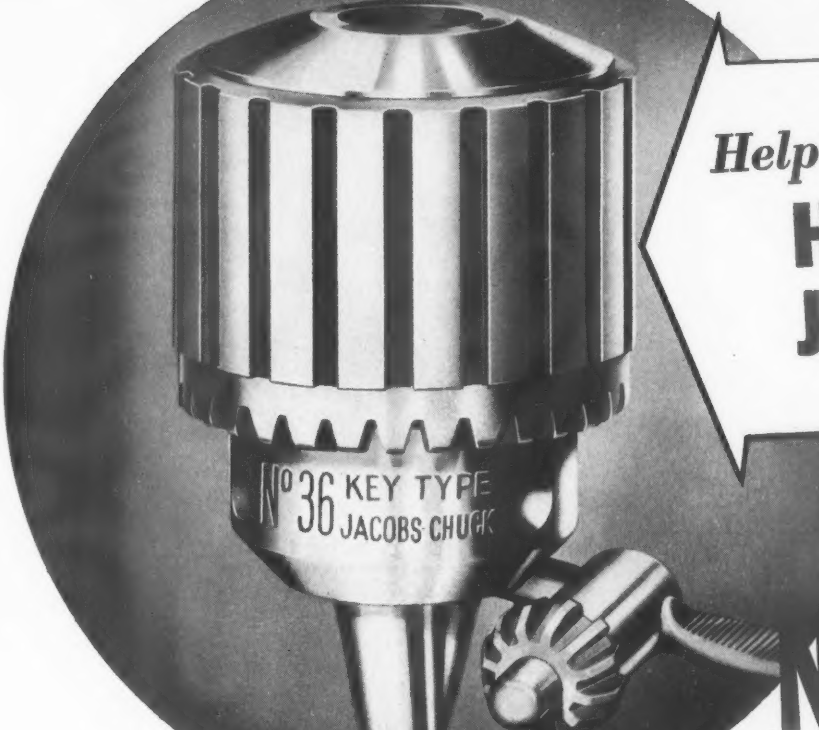
The dinner meeting was adjourned at 7:45 P.M. to enable those present ample time for driving to the Gorham Tool Company, which had a "special-crew-of-workers" on the job between 8:00 and 10:00 P.M. for our plant visitation. Among the highlights of the tour was a special casting of "Gorham Cast High Speed Steel" by the Centrifugal casting process.

Unusually fine weather resulted in rather meager attendance at the May meeting of the **Syracuse** Chapter. A lively discussion was held after a very interesting lecture on "Surface Broaching" by Mr. B. P. Schiltz of the Foote-Burt Company of Cleveland, Ohio. During the business meeting, Mr. William Metzroth, Chairman of the Constitution and By-laws Committee, led a discussion on the proposed changes in the Constitution. The trend of the discussion was heavily in favor of acceptance.

The A. V. Wiggins Company graciously acted as host for a special meeting held May 10 in the Syracuse Industrial Club. Mr. Howard Seaman, of the Behr-Manning Company, spoke on the topic "Sandpaper Grows up." This lecture was accompanied by a techni-color film showing the processing of sandpaper and other coated abrasives. One hundred and fifty-five attended this very excellent meeting and thoroughly enjoyed the lecture and the lunch which followed.

New York-New Jersey Chapter held its meeting on May 14. In opening the meeting, Chairman Walley Gray announced formation of the Greater New York Chapter No. 34 and read a letter from Andy Duncan, their Chairman, thanking our members for their assistance in helping them get started. Our own Tom Orchard who has been so active with us has been transferred to

(Continued on page 62)



Helping chuck users HELPED JACOBS

NICKEL ALLOY STEELS

● To improve their drill chucks and and to lengthen the service life of much-abused chuck jaws, the Jacobs Mfg. Co., Hartford, adopted Nickel alloy steels. Jaw life was lengthened—yet production costs were reduced! Nickel alloy steels save 75% of rejects formerly caused by warpage during heat treating. Jacobs writes about several advantages of using Nickel steels.

"The jaws of a drill chuck must be extremely hard along the lands or bite which grips the drill shank. Any wear on these surfaces, only .020″ wide and 1″ long, reduces gripping power and causes inaccurate drilling. In ordinary service, these jaws are subjected to a great deal of abuse.

"Until we adopted SAE 4615 Nickel-molybdenum steel we experienced great difficulty developing required hardness on lands of the jaws while retaining adequate core strength to prevent bending or breaking. The Nickel alloy steel jaws can be heat treated to a minimum hardness of 62 Rockwell (C) on the carburized case with good strength in the core. Since adopting SAE 4615 we have reduced rejects due to warpage in heat treatment by 75%.

"We have just concluded testing this same Nickel alloy steel for the nut of the chuck and have decided to adopt it there also. This nut must withstand bending or breaking even when a portable drill is dropped. On our .500″ chuck the former steel nut would stand a direct blow of 21 foot pounds. The nut made from SAE 4615 Nickel-molybdenum alloy stands a 55 foot pound blow without damage to threads."

NICKEL STEELS are strong and tough yet ductile and readily machinable. Nickel alloy steels respond *uniformly* to heat treatment. For more detailed information, in approved A.S.T.E. data form, please write for your copy of "Nickel Steels, Nickel Cast Irons and Non-Ferrous Nickel Alloys for Modern Production Equipment."

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

A.S.T.E. DOINGS

(Continued from page 60)

Chapter 34 and is their first Vice Chairman.

Walley Gray announced the appointment of two new committee chairmen: Mr. P. W. Brown from Wright Aero. on "Constitution and By-laws" and Ed. Murphy from American Can Company on "Educational Display."

Mr. d'Arcambal, National President, was the principal speaker and before he started his talk, he explained the proposed revisions in our Constitution and pointed out the proper method of voting on them.

Mr. d'Arcambal's talk on "Recent Improvements in Tools and Gages" was one of the most interesting of the year. He pointed out that the new alloys that have been introduced and must be machined make it necessary for 65% of the tools handled by tool vendors to be of a special nature for each job. Among these new alloys, he particularly mentioned Magnesium and the fire hazard in machining it and advised that a liquid fire extinguisher should never be used in such cases but instead it should be smothered with powdered asbestos. He explained that the machining of these new alloys made it necessary for high speed steels to be used much more widely than before and at present 80% of the taps, 85% of the reamers, and 95% of the milling cutters are high speed steel. The war in Europe makes it impossible to obtain enough tungsten to meet this demand for high speed steel, so molybdenum must be used in its place and Mr. d'Arcambal advised all to become more familiar with its application. New tool material and methods of heat-treatment have produced tools that show amazing results and Mr. d'Arcambal showed us milling cutters that run 1000 feet per minute for 5 continuous days between grinds. He also cited an airplane manufacturer who saved $3100 in tool cost in one year merely by changing the angle of flutes on a reamer proving that it pays to study a job thoroughly.

In gaging he recommended segregation of production parts to allow a greater manufacturing tolerance and in describing the new electric limit gages it was pointed out that by its use sheet steel mills have been able to increase their speed from 350 to 2000 feet per minute. Mr. Edwin D. Sherry of the United States Secret Service showed a sound picture and gave a short talk on real and counterfeit money.

Worcester Chapter held its May meeting on May 13. Approximately 110 attended the dinner and twenty more appeared later for the technical sessions. Mr. P. P. Sturgis of the Taylor Wine Company was the coffee speaker. He showed a short motion talkie picture of "Wines by Taylor." He also provided samples. It is hard to say which was enjoyed more, the picture or the samples.

Mr. Victor H. Ericson of the Norton Company was the guest speaker of the evening. His subject was "Refined Surface Finishes on Metal Cutting Tools." He showed two short pictures illustrating grinding methods in the modern shop. He accompanied this with an illustrated talk on Refined Surface Finishes as applied to Regrinding of Metal Cutting Tools. He told of the results obtained by rough grinding cutters with a 60 grit wheel, then finish grinding with a 320 grit wheel. He stressed the savings to be had by such a method. The boys gave him a big hand and it was generally agreed that our home talent is just as good as any from outside. "Vic" is a member of the Worcester Chapter.

Al Forbes, Chairman of the Boston Chapter, was present at the meeting. He extended an invitation to the boys to attend the May meeting of the Boston Chapter and also to come to the outing on the 22nd of June.

Bob Lippard, Chairman of the National Constitutional Committee, was on hand to give the boys a brief summary of the changes in the Constitution.

Springfield Chapter had a fine turnout for their April meeting which was held at the Hotel Bridgway. Eighty-five members and guests attended the din-

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A.S.T.E. DOINGS

(Continued from page 62)

ner and about seventy-five attended the meeting. One of the highlights of the meeting was the introduction of Past President Jim Weaver who gave us a short talk. It is always a treat to have Jim around.

Mr. Frank Hoaglund, Master Mechanic of Pratt & Whitney Division of Niles-Bement-Pond was scheduled to give a talk on "Machine Tools and their Care." Unfortunately Mr. Hoaglund had to cancel his engagement because of illness. We are quite sure that we missed an interesting discourse.

Chapter Chairman Frank Curtis was fortunate in being able to obtain a worthy substitute in Mr. Clarence Stevens, Production Engr. of New Departure who gave a very interesting talk on "Hydraulics and its application to machine tools." Mr. Stevens traced the development of the application of Hydraulics from its inception up to the present time. A question period followed the lecture.

Los Angeles Chapter held its meeting on April 25. There was an extra good turnout, approximately 130 of the members and twenty-five of their friends were present at the meeting.

Everyone was very much impressed with the methods of aeroplane construction they are applying in the Vultee Aircraft plant; also every member and friend was shown the height of courtesy by Mr. Jones who is Vice Chairman of Los Angeles Chapter. Other conductors, appointed by Mr. Jones, were members of the Vultee Personnel who were extremely courteous.

The body was divided into groups of twelve each which made it possible for everyone to be close enough to his guide to understand all explanations. Construction and procedure were very clearly outlined which proved to be very interesting and educational to all.

South Bend Chapter held its meeting on May 9. The speaker of the evening was Mr. Malcolm F. Judkins, of Firth-Sterling Steel Company, McKeesport, Pa., who gave a very interesting, technical discussion on "Firthite Sintered Carbide and Tipped tools."

The technical session opened after a dinner served to 110 persons. Mr. Judkins supplemented his lecture with motion pictures and slides. A business meeting followed the discussion and plans were discussed for an outing to be held about the middle of June.

Mr. W. A. Weatherhead, representative of the Brown & Sharpe Mfg. Company, Providence, R.I., exhibited newest developments in tool room equipment. Mr. E. B. Barber, Chairman of the South Bend Chapter, presided.

Cleveland Chapter held its regular meeting, May 10, at the Allerton Hotel. There were 84 at dinner and 109 at the technical session. Dinner music was furnished by Jim Drummond through his miniature broadcasting station A.S.T.E. He was assisted by Ed Mack of Strong, Carlisle & Hammond Company who furnished the radio.

Mr. Ed Howard, a new member from the National Carbon Company, put on a clown act demonstrating what the chairman of tomorrow would have to know to carry on his duties. This act was put on after somebody had "kidnapped" Chairman Clete Briner. Ed's act provided about fifteen minutes of good humor.

Weatherman Ralph C. Mize of the local U.S. Weather Bureau took over and gave a very enlightening explanation of "Why it rains when he forecasts cloudy today and tomorrow." Also of interest were his remarks concerning the various instruments required to check weather conditions.

Dr. Grove, Stainless Steel Metallurgist of the Republic Steel Company, was unable to be present due to illness. However, his place was ably filled by Mr. F. O. Reese and Mr. C. B. Pharo. They did an excellent job of handling the film and answering the questions during the discussion period. The picture, "Republic Enduro" was very instructive and interesting and depicted the fabrication of stainless steel from the ingot to the finished sheet. The handling of the 1000 pound ingots down roller conveyors to the rolling

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VOCATIONAL VIEWPOINT

(Continued from page 32)

work or attend High School during the day which means that they cannot tie up too much definite evening time during the week for actual attendance at classes. For this reason, attendance has been maintained at a high degree by having students attend classes only one night per week rather than the usual three or four, the student accomplishing as much as by the usual method or system of attendance, because he is given enough home work to make up for the variation in class attendance for the week. This home work can be done at the student's convenience, which means that nothing is lost by this change. Another successful point is this: Tool Designing cannot be taught in the same manner as the usual class work. It requires almost individual instruction and a great deal of time with each student. My experience has proven that large classes are considered necessary in conventional schools for the reason that the per capita cost of educating a student is set by the State, Municipality or the institution itself, as the case might be. This does not, and never will work out satisfactorily for the student studying this type of work. For this reason, all of my classes are limited to twelve students or less per class. Classes are of two and one half hour duration so that this arrangement insures what may be termed semi-private instruction.

Another deviation from the usual school procedure is this: when a student starts school he may have had some preliminary or elementary training along this line. We try to see that he wastes no time in doing work that he already knows. Further, no two students progress with the same rapidity so each student works independently. While a definite curriculum goes to comprise the course of instruction, a student may complete his course as rapidly as he is able to qualify himself for a position as a first class beginner or better in a tool designing department. While there are two semesters of twenty weeks each during each school year, these periods have nothing to do with a student's progress, as no definite amount of work is specified for completion during any one semester, as he simply continues where he left off at the end of the last semester when a new semester starts.

All work is practical and a student is required to create from the beginning. There is never any copying. If he has had no elementary drawing, we teach him how to use his instruments, not by the usual geometric problem process commonly known as mechanical drawing, but by making practical shop detail drawings right from the start. These are, of course, simple to begin with, but he is learning something productive at the same time and by this method it is only a matter of a few weeks before a student can detail a simple assembly. That already gives him a definite, practical toe hold in this profession because a great many organizations use detailers in their tool designing departments. While a real beginner is learning this detailing, he is also attending classes in blueprint reading and the blueprints given him for study are prints of jig and fixture parts such as conventional clamps, locating blocks, V Blocks, bushings, etc., so we are building up his familiarity with these parts which he will encounter and understand later on in tool designing.

As a student progresses, he starts the design of simple jigs and fixtures and he is by now taking classes in a related subject in which he receives enough mathematics involving the figuring of triangles so that by the time he is ready to detail and dimension his first drill jig, he will know how to figure the angles for properly dimensioning the location of the drill bushings. This related subject is composed of practical shop mathematics and also what we call industrial problems. The industrial problem part of this instruction takes the student through a dictionary of shop terms and a general discussion about elementary things in the shop with which he should be familiar. As students become more proficient they get into advanced tool designing, those less proficient, detailing the layouts and assemblies of the more advanced students. In addition to their tool design-

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UNIVERSITY VIEWPOINT

(Continued from page 25)

brass tacks, when you get the boy sitting along side of you in your office and you can pry into his mind to see whether he is the kind of a chap that ought to go into your field.

I interpolate this here simply because Mr. Stilwell spoke of it in his. And if that committee should approach any of you gentlemen that are here in the metropolitan region I hope you will give it your cooperation because that is the most fundamental thing that can be done in vocational guidance.

I have many friends in Teachers College of our University who are teaching vocational guidance, but they willingly admit that they cannot possibly know everything about all of the fields. They can give a general over-view. I can't possibly know everything about all the fields of engineering, I can only give an over-view. But if we could bring the student in intimate contact with you, the student who thinks he wants to be a Tool Engineer, for instance, then you can talk to him right from the heart, your own heart, and your own experience, and tell him whether or not he has the capabilities and aptitudes which should justify him going forward with an engineering education with the idea in mind of eventually becoming a Tool Engineer. That helps in these selective processes. Selective processes occur all during his engineering school program. These graduates are being extensively hired in industry where they make great contributions to progress. But in the special field of process machinery including machine tools and parts there have been but few highly trained technical mechanical engineering graduates.

As previously stated, Tool Engineering is a very important factor in production work and it obviously warrants the best technical training and education for all who perform and supervise its functions.

If the employers in the tool field realize their opportunities to secure mechanical engineering graduates, giving them the proper post-college training programs in the shops as is done in so many other fields, it can be reasonably predicted that there will follow the same basic and outstanding improvements as have occurred in other industrial lines.

HIGH SCHOOL VIEWPOINT

(Continued from page 30)

students in vocational education. No cooperative plan can become most effective without the unselfish cooperation of both industry and organized labor. I do wish to emphasize that, because that is one of the difficult problems we have in vocational education, the problem of cooperation.

It would be physically impossible for us in the vocational high school to secure enough funds to provide the machinery and equipment to set up a laboratory that would even compare with your own shop, the conditions under which these young men will work when they go out of school. Industry must be unselfish in that they should be willing to take these young men and young women, if it is girls' vocations, and give them an opportunity for some educational experience in your plants. Under no circumstances should they be used as producers in your plant. That is not the purpose of it. Because right there is where we run them with ordinary organized labor, and one of the difficulties we are having with organized labor in placing these youngsters cooperatively is that labor is afraid that these youngsters who are put in in the cooperative scheme become producers and take jobs that otherwise might be filled by men with families.

We have a job to do for the countless thousands of youth who are rapidly becoming a social problem and a problem on the labor market. We are beginning to know how it can best be done. With education, industry, and labor working together we are certain to succeed. Without this cooperation, failure is inevitable.

In conclusion, I have attempted to give you an overview of education and its many problems; suggestions as to what fundamental changes must be made in education that we may do the job better in the future than we have in the past; suggestions to you men as leaders in the tool industry how you may be helpful to us in giving a better "break" to the mechanically inclined

(Continued on page 74)

"Saved 100% with Delta Drill Press"

. . . *Says* WARNER & SWASEY

The photograph of the No. 1382 Delta 17″ Drill Press here shown was sent to us by the Warner & Swasey Company with the following notation: "This machine, equipped with a special table, is used exclusively for polishing counter-sunk holes in Warner & Swasey hardened ways. These holes were formerly hand-lapped. Savings: 100% over old method." This is but one of many Delta Drill Presses used for numerous small drilling operations in the Warner & Swasey plant.

Warner & Swasey make good turret lathes (we know because we use them), and are quick to adopt any methods that insure better quality and lower costs. Thousands of other manufacturers are also using Delta 14″ and 17″ Drill Presses for straight production work, for toolrooms and general machine shops, and for supplementing multiple spindle machines. Low first cost, lower operating costs, unusual flexibility—and splendid performance, make these drill presses a necessity in every progressive shop.

Ideal for Special Set-Ups, Too

In addition to their use as standard drill presses, the heads, columns and flanges, of these machines may be purchased as separate units so that special set-ups can be made. Their low cost makes them more economical than anything that can be made up in the tool room or machine shop. The heads can be used in any position, vertical, horizontal or angular, because their self-sealed ball-bearing construction eliminates all lubrication problems. Photographs sent in to us, showing special set-ups with Delta drill press parts, reveal how a little ingenuity can lick a tough job at a worth while saving in tool costs.

SEND FOR BULLETIN

Fill out and mail coupon for Special Drill Press Bulletin giving full details, description and prices of the complete line of Delta Drill Presses.

No. 1555—4 spindle 17″ Slo-Speed model has a 28½″ x 82½″ table, surface 23½″ x 77″, is 48″ high. Maximum distance chuck to table 26″. Drilling capacity ¾″ in cast-iron. Table has 1½″ oil trough. Single spindle, two spindle, 14″ and 17″, floor and bench type drill presses also available.

Delta Manufacturing Company,
667 E. Vienna Ave., Milwaukee, Wis.
Gentlemen: Please send me your latest Drill Press Bulletin which contains specifications and prices of your complete line of Drill Presses.

Name . . . .
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City . . . . **State** . . . .

DELTA MANUFACTURING COMPANY
INDUSTRIAL DIVISION
667 East Vienna Avenue, MILWAUKEE, WIS.

TOOLING MULTIPLE AUTOMATICS

(Continued from page 20)

and operated top, intermediate and lower slides. The placing of slides on the overhead arm of the machine has advantages for certain operations; and means provided for compound slides in various positions.

Another feature of the bar type of Acme-Gridley machine is the independent power index stock reel, which relieves the spindle carrier of all stock reel driving stresses.

These machines can be provided with hydraulic, electric, air or the conventional spool and finger chucking mechanism, as well as automatic chip conveyors. To complete parts requiring operations on each end of a piece arrangements are made for double indexing, as is the case with many machines of the multiple spindle type.

The New Britain Automatic

The New Britain automatic is made in the chucking machine of the tool rotating types with three and four spindles, carrying 6" and 7" chucks, and in the work rotating types in 4, 6 and 8 spindles, carrying spindles from 6¾" to 10" in diameter. Bar machines are made in seven sizes—from ⅞" to 2⅝" and in the 4 and 6 spindle types.

Features of design characteristic of these machines are the open end construction whereby the tool slide is not housed and the tools and accessories are carried on the outer end of the machine base proper. Another feature is the automatic lifting out of the spindle carrier from its bearings during index, relieving the bearings of wear incidental to the rotation of this large unit. These machines also feature forming arms which are independently actuated through separate feed cams. The chuck operating mechanism used in these machines can be any of the conventional types, but hydraulic chuck operating mechanisms have been highly developed by this company. The chucks, with this system, can be opened in any position at the will of the operator. Provision is made so that chucking pressures can be, if desired, automatically reduced in three variable steps in the last three positions. This is a valuable feature in preventing distortion when the chucking pressures are too great for holding without distortion during finishing cuts.

Machine tools in the Detroit area may be commandeered by the United States Government for the mass production of war materials it has been reported. Tool Engineers in the nation's industrial capital may then turn their efforts to other production problems than the manufacture of 1941 auto models.

SMALL LOT PRODUCTION

(Continued from page 52)

these things. This is true on practically all types of Screw Machines. With your permission I wish to outline the plan which we are using in our shop to meet this condition. No doubt like plans are being used in a number of places today.

After extensive timestudy research we have been able to compile standard time data charts, covering the handling, machine manipulation, machining speeds and feeds for the various materials with which we deal and practically all of the miscellaneous hand operations that are performed. These charts are used for setting the production rates, piece rates, and for estimating. At the time these rates are established on a job going to the shop, an instruction sheet is drawn up showing the method of chucking, the positions of the tools in the machine, the sequence of operations, the speeds and feeds to be used and other information that may be required. This method is proving quite satisfactory and well worth the time spent in preparation.

Order complete A.S.T.E. Convention transactions from A.S.T.E. National Headquarters, Detroit. Members, $1.00; non-members, $2.00.

(Continued from page 15)

operation it performs for comparison with the sequence of operations. We will not go into the other titles shown because they involve details of cam layout which are not germane to the subject of true deep hole drilling with revolving drills in alloy steels using a variable speed motor. You will notice however that the entire hole is redrilled to get the desired smoothness. It is not necessary to revolve this tool.

Figure 4

This illustrates features of a magazine of novel construction designed to hold 120 pieces for each complete load, for use on a well known type of single spindle automatic screw machine. Ordinary magazines are not adaptable to one minute operations on account of the frequency of loading when operators are running several machines and setting up another on precision work on unusual materials.

At the left we see a half section of a rotary device containing twelve tubes. It is anchored to that section of the machine tool to which screw slotting and other front cross slide devices are attached. The forward movement of the carrier arm from position number one to position number two is actuated by a "double movement" or accelerated slide beneath it and carries a piece from the magazine to the collet where it is loaded by the conventional spring plunger and chucked. The piece drops vertically into the nest in position number one and turns to a horizontal position through engagement of the groove in the carrier with the stationary key as it moves forward.

The carrier slide shown at the upper right is also attached to the "double movement" slide. As the machine cross slide moves forward the carrier slide starts the movement of the index slide. The engagement of the cam on the indexing arm with the front side of the cam on the locking plunger removes the latter from the slot and the rotary movement of the magazine starts. After it progresses a short distance the plunger drops to the outside diameter of the indexing plate and slips into the slot at the end of the stroke. When the return movement starts, the indexing arm now engages the rear side of the plunger cam and is removed from the slot. Rapid action in leaving and entering the slot is accomplished through the use of the two balls and spring shown in the center of the arm.

Pieces which are either over or undersize on the overall length stop the forward movement of the carrier arm. The front feed shaft of the machine then quickly drops out of engagement and the operator seeing no movement of the magazine is aware of trouble. Slots in each tube allow him to see from a distance the extent to which the magazine is loaded. It seems doubtful that this type of magazine can be used on older styles of single spindle machines of the make we use or multiple spindle machines which do not have a quick acting safety device, unless a 100% inspection of parts for overall length is first made.

Figure 5

To the left is a swing tool and in front of it the part with the shallow counterbore. The skim cut method was used by this tool to produce a finish impossible to obtain by an end cutting drill or reamer on this particular alloy steel with the sharp corner shown in the section of the neighboring piece.

To the right are two tools, one a standard type of oil drill and the other a fluted oil reamer with a tapped hole in its shank for coupling to a high pressure oil line. While oil is quite essential to the cutting edges of the tool, its main duty is to flush out chips so they will not be pressed into the bottom by the reamer and later, in the motor, be released by vibration to plug an oil supply. Note in the shank of the oil drill a groove to permit the use of a pin to fasten it to its bushing so it will not pull out if chips clog its highly polished flutes. An ordinary twist drill ground to a flat bottom was used be-

(Continued on page 76)

NEED FOR TOP RAKE

(Continued from page 50)

ial step on product into a relative amount in the inclined plane of top-rake. With the result, for circular form tools, reference is made to "Corrected Diameter Tables." When the flat form tool is to be considered, the amount in the inclined plane of top-rake is referred to "Flat Form Corrected Tool Step Tables" to arrive at the final result.

This system includes many tables, in fact, a complete set of tables for each circumstance of top-rake angularity, which naturally includes a set of separate tables for either circular form tools or flat form tools. In addition to the variable circumstance of top-rake requiring the many tables mentioned above, the setting of the cutting edge with reference to the centerline of the work can also vary and will require a distinctive set of tables which are included in the system.

The conventional non-rake or straight cutting edge form tool for the lateral or cross cut system can be used by only one general circumstance of set-up—the plane of the cutting edge must coincide with the plane of the centerline of the machine and the direction of travel of the cutting edge. Top-rake cutting edge form tools can be set up by one of three general arrangements. The first arrangement has only the point of the angular cutting edge coinciding with the circumstance of a non-rake tool set-up. All other points of the angular cutting edge naturally will not coincide with the centerline of the machine. This arrangement is the nearest possible approach to the non-rake circumstance of tool setting. Another condition is when the outermost edge of the tool passes the center of the work. The outermost point of the cutting edge passing beyond the center of the work will apply to combination form and cut-off tools or combination end-facing and form tools. Placement of the cutting edge above the centerline is another condition for top-rake setting of tools. Each of the three general arrangements of top-rake cutting edge setting requires its own method of calculation and particular set of tables.

When a form tool is manufactured for use with top-rake, it should be marked to show the proper gashing to insure the desired rake angle when it is placed in the normal operating position. This information will assist the set-up men and operators in the correct usage of top-rake.

HIGH SCHOOL VIEWPOINT

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youth of America—youth that do not desire to go on W.P.A., do not desire to become social and economic parasites, but do desire jobs that they may become decent, self-supporting, self-respecting citizens in this the greatest democracy on earth.

Education if properly directed costs money. If we do the job as we all know how it should be done in the fu-

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INDUSTRIAL REQUIREMENTS

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of two years of solid work, and will very shortly be off the press. We believe that with the rapid rise in employment in the metal working shops at the moment the present fearful lack of skilled machine operators can be somewhat reduced by an effort at specific training of the men concerned with our own product.

It is our plan to present this form of self education, if you please, or to combine it in a variety of ways with man operator training efforts now quickly being developed in certain areas especially around the aircraft industry. We expect to send into the field a group of young engineers who will present the general outline of this material and then develop its use in any one of several different ways. It is a most comprehensive encyclopedia covering turret lathe technique and tooling method and is one form of effort which we are hoping to contribute as a service to industry in a way which will reflect beneficially to your group as Tool Engineers.

In all that I have said here I have, perhaps, failed to offer a system or a method of education. But I am so vividly impressed as I grow older in constant contact with engineers, that one of our great weaknesses in engineering practice is a proper evaluation of these, so called, abstract qualities which so largely contribute to our relation with one another as human beings, that I have wanted to state them in this way.

The hardest thing about making good is that it has to be done every day and any hesitation in that continuing process arising from a lack of faith in the future or faith in other people or faith in our individualism seems to me to make for most of our troubles and most of our inefficiencies.

HIGH SCHOOL VIEWPOINT

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ture it will cost more. If society is not willing to pay the price for a real program of functional education, it must pay a far greater price for something that had better been education. Let me illustrate: Last year it cost a little better than $2,000,000,000 to carry the whole load of education. Last year it cost better than $15,000,000,000 to pay the price of crime. There is a relationship, most deifnitely. If you will check the school grade achievements of the criminals in our penal institutions you know the answer.

The answer, to a far greater degree than you may suspect, lies with men like you who are the great leaders of American industry. Let's move forward, let's open the doors of opportunity to this large percentage of American high school youth who have never had a chance under our traditional system of high school education.

SCREW MACHINE TOOLING—AIRCRAFT

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tween the oil drill and reamer. The cut-aways of the parts produced are examples of finish obtainable under the best of conditions in some of the alloy steels we machine but they are not smooth or close enough for size or concentricity for highly stressed parts in aeroplane motors. Grinding operations must follow to complete these parts to pass inspection.

Figure 6

This plate illustrates an application of tungsten carbide for machining a non-ferrous metal used for valve seats. To the left is the tool holder with three inserted bits which are responsible for the highly burnished finish in the hole. Set screws swivel, center, adjust endwise and clamp the cutting tools. Plenty of rigidity is assured. Obviously the first correct piece was the most difficult to make due to numerous adjustments, but once made, resetting of tools after grinding is one of those things an experienced screw machine operator understanding the principle of the micrometer screw became very capable of making. The radius has to blend with the seat angle in the front and a straight hole with a 1/8" land in the rear. By setting the tools .015" to .020" above center the smoothest finish is obtained.

The stud you see in the end of the holder retained a pilot when originally designed. This was discarded because as the tools removed the metal from the hole the piece closed in on it. When parted from their chucking rings they spring out of round as much as .017"; total indicator reading. So it is necessary to again grip them lightly on the outside diameter and to use a finishing combination of tools in the same type of holder in order to round them. Grinding the outside diameter from the hole removes the last trace of out of roundness.

Figure 7

The two circular form tools at the extreme left are relics of the year of 1916 and were used in the plant of the Simplex Automobile Company. Note the pitted condition on the sides of one and the face of the other. Tool makers polished the pressure faces quite skillfully after heat treating without materially changing dimensions. The second tool was not cleaned up because skim cuts followed.

The next two pairs of tools represent modern ones to produce the parts shown. The first of each from left to right cuts off and rough forms; the second finish forms. While the radius on the washer appears smooth it still requires a light polishing operation. The pin shown in the center has a straight diameter for 1/8" and then tapers to the end. Milling operations on the head necessitate squareness and close tolerance on the locating diameter.

Solution to Plate 1

We realize in the time allowed with the showing of Plate number one that it would take a keen mind to solve this problem in such a short time. In the first place there is a joker in the deck. In the so called temporary solution in column number two in position number three and column number three, position number three a combination reamer is shown with an oil hole. We have intimated in our plate on reamers that oil holes are sometimes necessary to flush out chips in deep holes. Therefore on a short hole this would not be necessary unless there was a chip problem. Consequently the oil under high pressure would force the chips out of the flutes, so a chip stripper is not necessary on this tool. It is necessary in position number two where this drill produces plenty of chips. In column number four, position number two, you will see a combination drill. This type of tool, provided the small diameter is not too long, has a tendency to carry away chips. There are two different diameters cutting, consequently there are two surface speeds for the diameters. Each will produce a different type of chip at the same feed, the small diameter a stiff chip which readily works its way out of the hole until it encounters the curly type of chips produced by the larger diameter where its stronger thrust

practically clears both away. Combination drills are expensive so we prefer to eliminate them where possible. In column number four also, in position number two, a knee turning tool is shown. It is on the rear side of the piece and inasmuch as it must be inverted in this position due to the stock rotating counterclockwise, it throws the chips down and does not tangle with the chips from the drill. This furnishes the cue that there will be no trap in column number three, position number three and no stripper will be necessary. The knee turner throws the chips down. The form tool on the front slide curls them upward. The reamer working as an auxiliary can be returned by high speed before the cross-slide to get a quick flush of oil to wash out the few chips which the oil rushing through the reamer failed to dislodge. A six-spindle machine may offer an even better solution and when available will be tried out.

A.S.T.E. DOINGS

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mills, being tossed about as if they were tooth picks instead of a mass of metal, and other highlights, held those attending spellbound. We were shown the necessary operations required to bring this stel to a mirror finish, polishing, buffing and hand wiping, and the task of handling and packing so as to eliminate scratching. A few of the many applications of this steel were shown, such as kitchen utensils, cutlery, building trim and streamline trains.

Among those present were Mr. Carl Soeder of the Republic Steel Company, Sales Department, and Mr. W. H. Pose, General Manager of Black & Decker Company, Kent, Ohio, to whom we are indebted for arranging this meeting.

Rockford Chapter held a plant tour, replacing the regular May meeting. "In spite of the heavy snow and rain, fifty of the scheduled eighty delegates from Chapter 12 arrived safely at the Allis-Chalmers plant in Milwaukee, where they were met by guides assigned to show them through the plant. Some of the most outstanding features noted by the visitors were: the massiveness of the work; the ease with which those great castings were handled; the variety of the work; the cleanliness of the shop and, above all, the cordial welcome extended their guests.

The free lunch at noon was certainly fine and bespoke the generosity of our host."

York Chapter's May meeting was a big success on its second anniversary and Executives Night. Mr. John M. Fenlin, of the Bakelite Corporation, gave a very interesting talk on "Moldable Plastics and Their Properties." The sound motion picture "The Fourth Kingdom" was shown in connection with the lecture.

Ford Lamb was the Coffee speaker and gave a short but impressive talk on "Education and Its Relationship With The Tool Engineer." Connie Hersam, who was also on hand, pledged his co-operation and stated he sometimes wonders if he is a York or a Philadelphia Chapter member as he feels that York is his "baby."

It was decided to hold our first annual outing in June and plenty of eats and a good time is in store for all.

Schenectady Chapter held its May meeting in Rice Hall of the G.E. Co. 125 members and guests were present to hear Mr. Schlitz talk on "Modern Surface Broaching." Lantern slides illustrated tools and parts now being produced by surface broaching, with production figures and broach life. The motion pictures "Science and Principles of Turbines" were also very interesting and instructive.

At the business meeting preceding the talk, our Secretary, Don Saurenman, read the modification of the constitution. Harry Crump, in charge of entertainment, announced a clambake to be held at Endries, September 14.

The following committee chairmen were appointed: Fred Law, Meetings and Arrangement; Nelson Coxe, Constitution and By-laws; A. G. Cochrane, Membership; George E. Lauterborn, Publicity; Harry Crump, Entertainment.

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LOOKING AROUND

By Perry Scope

Now fellows, there is a question that needs propounding and also compounding with a few questions and answers. I am sure some of our executives would have more hair and less worry if Tool Engineers in the past had had the answer clearly defined and had followed its suggestion.

Don't misunderstand me, there are other elements important to Tool Engineers. You might divide designing ability equally into four parts: Theory, Horse Sense, Invention, and Practice.

1. Theory:
   a. Education
   b. Basic Principles
   c. Calculation
2. Horse Sense:

This is that ability which permits one to put himself in the other fellow's place. That is: change his personality progressively as he proceeds with each job from designer to user through each of the intermediate steps. Can you take an inventory of yourself? Your boss does.

3. Invention:
4. Practice:

Practice is nothing more or less than proven theory—that is, all thought is theoretical until it is proven practical, after which it is accepted as fact. In other words, an hypothesis has no value to society except that it invites a few scientists and theorists to think along tangents which eventually may lead to the establishment of fact. In the meantime, the layman sets these theorists on a pedestal in praise of something which he believes great because he does not understand it. Oh yes, I know many great dreamers deserved higher pedestals than were given them, but they were practical dreamers. Actually though, thought has little tangible value until it is proven practical. So I repeat, we must be practical in thought as well as action. In the Feb. issue of The Tool Engineer, this column contained an "Alphabet for Tool Engineers" which is based strictly on good practice. Read it. Read magazines and journals which cover your field and problems. Remember every decision you have to make is a problem until you have the answer—and a practical answer. It may have been answered for you by another's experience. Yes indeed. Read—I was going to say, in your spare time—but perhaps you are like me, you don't have any spare time. So put reading on your **must** list;

Join the A. S. T. E. if you already haven't done so. Get your practical associates to join too. Its cost is extremely low, much lower than any other engineering group of which I know. You will find that everyone talks the same language at those meetings. Bring that chap along who shows so much promise. He will be elated and helped and will be forever indebted to you. Particularly is this true if you will make possible his joining the A. S. T. E. as a Junior or Student member. And if there is any one thing we could do, it would be to guide those youngsters who attend our meetings and members of our student chapters to become more practical.

If I had to choose one of the above mentioned elements as the most important, it would be hard for me to make a choice between the second and the fourth, that is, Horse Sense or Practice—in fact, they are closely allied. If it had to be one though, it would be the latter. Above all, be practical, and join in your work and problems with men whose problems are akin to your own.

Bear this in mind— When men join in a common idea or ideal, they gain

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VOCATIONAL VIEWPOINT

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ing, advanced students also receive instruction in Operation Sheet Analysis. This has nothing to do with laying out or writing operation sheets, but merely teaches the purpose of operation sheets and how to use them in connection with the designing of tools.

When a student completes this work he is no liability to any tool designing department. On the contrary, I have delivered students who never had any previous instruction, to tool designing departments, where they were found to be capable of working along with experienced tool designers, and these results were accomplished in less than nine months of instruction on the basis of one night per week. The majority of students have received promotions from the shop to some kind of Tool Engineering job while still attending school and these are giving definite, satisfactory service to the Company employing them. Under this method of instruction and with the course as outlined, it takes the average student about three semesters to prepare himself professionally for this type of work.

Practical courses in other branches of Tool Engineering would work out just as satisfactorily as the one outlined for tool designing and if Vocational Schools would lay out their courses in a more practical manner and employ only practical men for instructors, then industry could receive from them, young men qualified to take over and run a definite job without additional company schooling.

Therefore, I suggest an effort on the part of Vocational Schools to establish courses that are really more practical and the employment of real practical instructors. I suggest that courses representing higher educational subjects related to Tool Engineering be conducted by the colleges and universities leading to a Tool Engineering degree. However, I believe that practical courses such as I have outlined and which should be given by Vocational Schools should be a prerequisite to the college entrance for attaining this Tool Engineering degree.

LOOKING AROUND

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strength almost in proportion to their numbers up to some maximum where we find an indefinite yield point. But if a group has as an objective self improvement in ability and service to mankind, then they have a common heritage—which is all too uncommon in these ominous days—a common heritage that carries with it the great satisfaction of having contributed to the really worthwhile things in this life.

Perry Scope

P.S. The fellow on the other side of the fence is always greener.

A.S.T.E. DOINGS

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The door prize, a 1941 Renewal Membership, was won by Edward Narosly.

St. Louis Chapter held its regular monthly meeting Thursday, May 9th, at the Melbourne Hotel. After dinner, the members were kept very interested with a double feature program. The first speaker was Major H. W. Cochran, who supplemented his brief talk with moving pictures, that clearly showed military operations in the invasion of Poland and Finland. The second speaker was Mr. Herman Zorn of the V & O Press Company, who described with slides interesting punch press operations. With only one more meeting before summer recess, the emphasis is on the annual picnic which is to be held Saturday, July 13th.

At the last meeting of **Springfield** Chapter No. 32, John Haydock, Managing Editor of American Machinist, gave an inspiring talk on "Modern Trends in Machine Tools," before another record-breaking group. A mighty appropriate subject indeed, at a time when most of us are faced with not only the necessity to modernize our plants, but also with the possibility of doing our share in the new preparedness program. The meeting was held at the Westinghouse Auditorium following a dinner in the company restaurant. A Pan American Airway sound film was also shown as an added feature.

"Old" MacBriar, Membership Chairman, and his gang, brought in some new members, which is always in order. Harold Craig, Meetings Chairman, has some top-notch speakers lined up for our Fall Meetings. He says, "Bigger and better programs is our motto."

All members are looking forward to the first annual outing on Saturday, June 15. Kenneth Abbe, Entertainment Chairman, has plans completed for a real session, with a clam bake as the feature attraction. For those who play golf, arrangements have been made to tee off at Franconia from 7 to 9:30 A.M.

(Yes, we have some early bird Tool Engineers, such as Ed Sheldon). A luncheon will be served at Turner Park at 12 o'clock, followed by many sports such as soft ball, tennis, bowling, and swimming, then with the clam bake as grand finale at about 4 o'clock. Some mighty swell prizes will be awarded and a large turnout is anticipated. Every member has been asked to bring a friend. Reservations must be turned in by Monday, June 10th, to Kenneth Miller, 41 Taylor St., Springfield.

May meeting **Boston** Chapter brought together 140 members and guests in Walker Memorial Hall at Massachusetts Institute of Technology on May 16th for dinner. Mr. W. Nelson Bump (American Airlines) gave the after-dinner talk, sketching some of his early experiences in airline operating, concluding with a sound film showing the features of modern air travel. Later, in the main lecture hall at M. I. T., Bob Lippard (Chairman, Constitution and By-laws) explained the proposed changes in the Constitution.

Feature of the program followed; V. H. Erikson on his researches into "Effect of High Finish on Cutting Tool Edges"—a very up-to-the-minute subject. Harry Swanberg (also Norton Company) showed a new colored talkie "Tool Room and Precision Grinding." This Chapter recommends Mr. Erikson and suggests that should other Chapters run across this gentleman, his "Southern Hospitality; or, the Split-Spitz" story be called for.

GRAND RAPIDS ORGANIZING A.S.T.E. CHAPTER

A western Michigan chapter of the American Society of Tool Engineers is being organized through the efforts of Mr. Joseph Monohan, 351 Indiana Ave., N.W., Grand Rapids, Michigan.

The Chapter will include the western Michigan area, including Muskegon, Allegan, Three Rivers, Hastings, Grand Rapids and other nearby cities. Tool Engineers who are interested should get in touch with Mr. Monohan at the above address or write to National Headquarters of the A.S.T.E. in Detroit.

Industrial Relations Committee A.S.T.E.

PERSONAL SERVICE FOR MEMBERS

SITUATIONS AVAILABLE

ENGINEERING COMPANY IN DETROIT HAS OPENINGS FOR MACHINE DESIGNERS.

TOOL AND DIE ENGINEER—35 to 45 years of age to work on the design and development of new precision punches and dies for simple, compound, and progressive operations on presses used in the fabrication of small, intricate, close tolerance metallic parts. Location, Northwestern Pennsylvania.

EXPERIENCED MACHINE TOOL INSPECTOR with the background of thorough machine shop or tool room training, or a young machine tool engineer who is willing to work on the inspection and acceptance of finished machines and the tooling that goes with them.

Also a mature man with broader experience to supervise the work of a few men of the above type and to do similar work himself. The locations for the above work are in the Connecticut Valley, in Cincinnati, or in Milwaukee. The senior men and some of the junior men would have some traveling to different shops with expenses paid.

SITUATIONS WANTED

SALES ENGINEER — Experienced on machine tools, small tools and materials for industrials in the New York Metropolitan area. Technical graduate with practical engineering background. Interested in high-grade products requiring engineering and sales ability.

MAN WITH TWENTY YEARS EXPERIENCE which includes machine shop superintendent and production superintendent work is desirous of obtaining supervisory position.

MAN WITH SEVENTEEN YEARS EXPERIENCE which includes tool designing, tool design supervising, industrial engineering, and plant superintendent work, available for supervisory position.

THE A.S.T.E. has several recent applications on file from men of wide experience that are capable and very much interested in securing a position as shop foreman or superintendent.

For further information contact the American Society of Tool Engineers, Tyler 5-0145, or write to 2567 West Grand Boulevard, Detroit, Michigan.

PRODUCTION PERSPECTIVES

(Continued from page 42)

The **RTC Shipbuilding Corp.**, newly established **Camden shipyard**, believes in getting right to work. The company **laid its first keel**—for a steel tanker—**only 20 working days after it started in business.**

The **Allegheny-Ludlum Steel Co.** is constructing a fine wire mill, 280 by 180 feet, sawtooth construction, which will cost $90,000, at Dunkirk, N.Y.

Middlewest

Plans for a **half-million dollar expansion program at the Mansfield, Ohio, plant of the Westinghouse Electric and Manufacturing Company** is **announced by L. E. Osborne, manager of manufacturing and engineering** of the Westinghouse Merchandising Division.

Work will start within a month on the expansion program, which will increase the Mansfield plant's capacity in production of household refrigerators by one-third, Mr. Osborne said. **Cost of the program**, including buildings and equipment, **will be somewhat in excess of $500,000.**

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PRODUCTION PERSPECTIVES

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East

Increased business at the H. E. Dickerman Manufacturing Company, Springfield has **made necessary construction of a new factory.** The **company manufactures punches, dies, jig fixtures and gauges, punch press feeds and stampings.** Transferral of activities to the new location will be completed by June 1.

Raymond L. Chevalier, former works manager of the Wright Machine Company of Worcester, and a foreman in the screw department of the Westinghouse Electric & Manufacturing Company for 15 years has **organized the Falls Screw Machine Company of Chicopee.** Six automatic screw machines and the necessary auxiliary equipment such as lathes, drilling machines, shapers and such have been installed.

The **Stacy Machine Works, Inc.,** of **West Springfield, has moved its office and half of its shop to** the **former Bemis & Call building in Springfield,** where it will have increased space. Twenty machines have been installed in the new location and others are expected to follow. The company has been established in West Springfield for 15 years.

Machine tools continue to provide the mainstay of industrial activity in Worcester with **practically every firm running extra shifts** in an effort to meet production schedules. The great **bulk** of the machinery being produced is **for aircraft companies.**

Employment at the Chapman Valve Company, Springfield, has **picked up about 20 per cent** and 1,500 are now on the pay roll for that concern. **Westinghouse continues busy** and is away ahead of last year, **W. O. Lippman,** works manager, **said.** Employment has increased as well and 3,200 persons are being employed at the East Springfield plant.

Substantial **gains in employment in industrial and manufacturing concerns in Western Massachusetts** are **reported in employment surveys** conducted **by the Springfield Chamber of Commerce,** and the Western Massachusetts branch of the National Metal Trades Association.

Wright Machine Co., Worcester, is segregating a portion of its plant with steel wire guards and screens preparatory to carrying out a government contract which it was recently awarded. Several additional machines will be installed.

The **American Steel & Wire Co.,** Worcester, is **operating** a **new type continuous heat-treating furnace.**

Contracts have been **awarded for erection of a new building for the plastics department of the General Electric Co., Pittsfield,** and work will start soon. The new structure will be one story of brick and steel construction, 165x75 and will cost $50,000.

William H. Wheeler has been **transferred from the Holyoke works** of the **Worthington Pump and Machinery Corporation to the main sales office in Harrison, N.J.** He has been assistant sales manager of the convertible compress division and is being promoted to manager of the compressor sales of the Worthington's merchandising division.

William E. Blake, formerly production supervisor at Westinghouse, East Springfield, was killed in an automobile accident May 5, in Darlington, S.C.

David M. Hood, foreman for the **Curtis Universal Joint Co.,** Springfield, **died recently.**

Lucius B. Grimes, 94, founder of the Grimes & Harris machine shop, Leominster, died recently. In 1904, with James F. Harris, he founded the machine shop. Harris and his son, Roy M. Harris, still conduct the business.

A **continued heavy flow of business and large backlogs** built up during the buying spurt last fall **have sustained operations in the machine tool industry in Rhode Island at the peak rate** which has been in evidence in recent months, **reports from the industry indicate.**

Worcester Pressed Steel Company of Worcester, is **installing a new hydraulic press** and **new annealing furnace.**

ADVERTISERS INDEX

THE SPIRIT OF JACKNIFE JOE . . .

Old Joe could whittle the durndest things out of any old piece of wood that came handy. Ship model, whistling boy, bird in the cage. Name it. Joe could whittle it.

Production en masse was never in Ole Joe's category. Cost of production never worried him. Time and labor was something people took delight in.

Successful business 1940 style has come a far way from Jacknife Joe's philosophy of "sure I kin make it." Today, it asks itself: "Can we make it so that we can sell it at a profit?"

Yet there are plants that seek these profits with methods that disclose a realistic kinship to Jacknife Joe.

With lathes for instance that still run as good as ever, yet as incapable (as the knife of Jacknife Joe) of making a contribution to profits.

Ever consider the fact that new improved LeBlond Lathes are being built because your competitors are demanding them? In a free country, too, where the same tools are available to all.

THE R. K. LeBLOND MACHINE TOOL CO.

CINCINNATI, OHIO

STEP DOWN COSTS *with a* **LeBLOND STEP UP PROFITS**